JOURNAL OF THE

SMPTE

82d CONVENTION — ADVANCE PROGRAM — FRIDAY-WEDNESDAY October 4–9 / PHILADELPHIA

volume 66 • number 9

SEPTEMBER 1957

JOURNAL of the
SOCIETY OF MOTION PICTURE AND TELEVISION ENGINEERS

PUBLICATION OFFICE TWENTIETH AND NORTHAMPTON STREETS, EASTON, PA.

Editorial Office

55 West 42d St., New York 36, New York

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SOCIETY OF MOTION PICTURE AND TELEVISION ENGINEERS

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Journal of the Society of Motion Picture and Television Engineers

VOLUME 66 · NUMBER 9 · SEPTEMBER 1957

The Infrared Transparency of Magnetic Tracks

By GEORGE LEWIN

This paper is of particular interest because in 1952, at the Convention then also in Washington, we had questions from the floor on a paper that I gave on the subject of magnetic standards. There was a great deal of discussion about the problems of half track and uneven headwear; and George Lewin at that time asked the question from the floor if there was any possibility of transparent magnetic tracks as a solution for these problems. There was a dead silence; no one was willing to answer him yes or no. Now he has evidently provided a possible answer to his own question.—Ellis W. D'Arcy, Session Chairman.

The author has discovered that magnetic tracks are substantially transparent to infrared light. Utilizing the infrared sensitivity of the lead-sulfide photoconductive cell, it is shown that excellent reproduction of an optical track can be achieved even though it is completely covered by a magnetic stripe. By thus eliminating the need for half-width stripes, superior magnetic recording quality is obtained while avoiding most of the drawbacks of combined magnetic and optical tracks on composite prints. Potential advantages and applications of the discovery are discussed, and avenues of research for further improvement are pointed out.

IN OCTOBER 1952, during this Society's Convention at Washington, D.C., a Symposium on Magnetic Striping was held.[1] Among the many problems discussed at that time, the one mentioned most frequently was that of placing a half-width stripe on a composite print so that the optical track could be used as well as the magnetic.

Many advantages can be derived from this dual usage, including the following:

1. Making of dual language films.

2. Changing the magnetic recording to conform with local dialects while permanently retaining basic version on optical track.

3. Modernizing the narration on training films without the need of re-shooting the picture.

4. On 35mm theatrical films using multi-magnetic stereophonic recordings, it is economical to include a single optical track for those theaters which do not have magnetic facilities; however, at present this requires some sacrifice of picture area even though a half-width optical track is used. (Such prints are known as "Mag-Optical" prints.)

5. With the recent advent of prestriped raw stock for newsreel coverage, it would be desirable to record simultaneously on both magnetic and optical tracks for added protection, or to provide simultaneous captions, or a running translation of foreign language speeches, etc.[2]

6. If satisfactory quality could be achieved on both magnetic and optical tracks, they would make stereophonic recording on 16mm film feasible.

A number of disadvantages of the use of half-width tracks were discussed at the Symposium in 1952, including the following:

1. Half-width magnetic track has low output, poor signal-to-noise ratio, and is very susceptible to magnetic dropouts.

2. Application of a half-width stripe is very critical since it must follow the center line of the optical track to avoid distorting its reproduction.

3. Irregularities in edges of track cause noise and level changes not only in optical reproduction but in magnetic reproduction as well, since heads must be wider than stripe in order to accommodate any position of stripe as well as full-width stripe.

4. Full-width heads are subjected to uneven wear by half-width tracks, resulting in loss of magnetic quality and danger of scratching optical tracks, necessitating more frequent replacement.

5. Misplacement of half-track, or excessive weave of optical track, can completely obliterate low-level modulation of single bias line recordings.

Desirability of "Transparent" Magnetic Stripes

All of the above disadvantages were discussed at the Symposium, but no satisfactory solution was advanced. This led the author to propose — perhaps with tongue in cheek — that it would be very desirable if a way could be found to make the magnetic stripe transparent.[3] This would literally permit the optical and magnetic tracks to occupy the same space at the same time and provide the following advantages:

1. Magnetic stripe could be fully 100 mils wide, thus giving 6 db higher output and better quality for same input.

2. Application of stripe would be less critical.

3. Head wear would be uniform.

4. No danger of distorting optical track.

5. Improved quality from both magnetic and optical tracks could make their use for stereophonic recording on 16mm feasible.

6. Could provide Mag-Optical 35mm prints without sacrifice of picture area as at present.

7. Would permit an optical track under each magnetic track of a multi-magnetic composite print without using any extra

Presented on May 3, 1957, at the Society's Convention at Washington, D.C., by George Lewin, Army Pictorial Center, 35-11 35th Ave., Long Island City 1, N.Y.
(This paper was first received on April 26, 1957, and in final form July 18, 1957.)

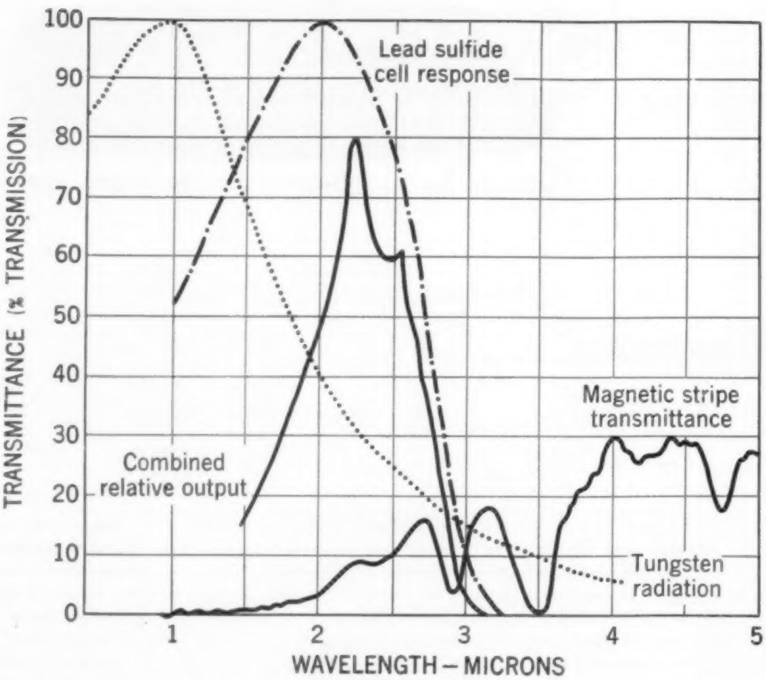

Fig. 1. Spectrographic characteristics of system. Tungsten radiation and lead sulfide cell responses and combined output are in arbitrary units. (Magnetic-stripe transmittance curve, courtesy of Reeves Soundcraft Corp.; other data, courtesy of National Bureau of Standards and Bell & Howell Co.)

space, thus doubling the number of available soundtracks.

8. If applied as a prestripe to raw stock, would permit simultaneous recording of an independent soundtrack at the same time that an optical single system soundtrack and picture are being photographed.

However, the suggestion for a "transparent" track apparently had no obvious solution, because none was offered during the ensuing 4½ years, and the problems of half-width stripes continued unabated.

Discovery of Infrared Transparency of Magnetic Stripes

In February 1957, the author discovered that magnetic stripes under certain conditions actually were transparent to a considerable degree. This discovery came about as a result of observing that the optical track on a print with a misplaced half-stripe, which sounded very bad on a commercial projector, sounded quite acceptable on a standard Army JAN projector equipped for optical sound only. Moreover, an optical track which was completely covered by a full-width stripe, and was completely inaudible on a commercial projector, sounded quite normal on the JAN projector, requiring only a slight increase in gain setting.

This rather startling discovery was quickly explained by the realization that the only radical difference between the JAN projector and most commercial projectors was the fact that the JAN used a lead-sulfide photoconductive cell in place of the more conventional caesium oxide-silver photoelectric cell. The characteristics of the lead-sulfide cell have been adequately described in the literature.[4–6] The most important characteristic, as far as the transparency effect is concerned, is that the lead-sulfide cell is very sensitive to radiant energy between 1 and 3 μ, while the caesium cell peaks at approximately 0.8 μ and is completely insensitive beyond 1.1 μ.

It was quite evident, therefore, that the magnetic stripe was transmitting some energy from the exciter lamp in the 1–3-μ region and that this energy was being detected by the lead-sulfide cell.

It is rather surprising that this phenomenon had not been detected and exploited long before this, since the use of striped prints has been quite widespread for the past four years, and many of these prints must have been run on JAN projectors. The only earlier reference which investigation has disclosed was by Raymond Snyder, of the Signal Corps Engineering Laboratories, who noticed it around November 1955, while preparing some special equipment for an Army Agency. Unfortunately, with the projector he was using, the loss of level was rather great and was accompanied by fairly high distortion, and he, therefore, did not attach great importance to it. The author has since found that many lead-sulfide cells exhibit distortion and lack of uniformity, especially with respect to infrared characteristics, and this will be referred to later on.

The type of magnetic stripe with which the transparency effect was first discovered was the Reeves solvent type. In fact, it was discovered on the very first roll of film which was striped on a newly installed Reeves Striping Machine. It was felt that one of the first questions that would require an answer was whether or not the effect would be present in the laminated type of stripe made by the Minnesota Mining & Mfg. Co. Laminator. Accordingly, some samples of this type were obtained and tested. It was quickly established that for all practical purposes the effect was identical with both types of stripe.

Spectrographic Characteristics of Magnetic Stripes

It was then decided to make some spectrographic tests to explore the degree of transmission of various types of stripe with respect to the wave-length of radiant energy. For this purpose the assistance of Edward Schmidt of Reeves Soundcraft Corp. was enlisted. He provided several spectrographs of various types of stripe. One of these is reproduced in Fig. 1. Additional data superimposed on this graph were supplied by Malcolm Townsley of Bell & Howell and T. C. Bagg of the National Bureau of Standards. These show the radiation characteristic of the tungsten filament exciter lamp and the relative spectral sensitivity of the lead-sulfide cell used in the JAN projector. It will be noted that the magnetic stripe has no transmission at 1 μ. It then rises to a peak of 17% at 2.7 μ and falls sharply to about 3% at 2.9 μ. The increased transmission at longer wavelengths (especially 4–5 μ) is of great interest for further research but obviously has no value with the present type of exciter lamp and photocell. The fourth curve (obtained by multiplying the ordinates of the first three curves together with an arbitrary factor to bring it into a clear portion of the graph) shows the combined relative output of the present system. It will be noted that it peaks sharply at about 2.2 μ. It should be obvious that if the tungsten radiation and the lead-sulfide sensitivity could be altered to peak at 2.7 μ, there would be a very large increase of combined output.

The spectrographs of various stripes, both Reeves and Minnesota Mining, showed, quite interestingly, almost identical peaks and valleys with respect to wavelength; however, some showed decided differences in the amplitudes of the peaks.

Some of the Minnesota Mining

Table I. Effect of Magnetic Stripe on Frequency Response of Optical Track.

Freq., SMPTE Serial #1048	Actual Output Levels: Before striping (normal gain)	After striping (gain raised 11 db)	Rel. effect of stripe on freq. response
400	+20.0	+20.0	0.0
50	+20.1	+20.0	−0.1
100	+21.5	+21.4	−0.1
200	+21.1	+21.1	0.0
300	+20.6	+20.3	−0.3
500	+20.4	+20.2	−0.2
1000	+20.8	+20.6	−0.2
2000	+20.1	+19.8	−0.3
3000	+18.8	+18.2	−0.6
4000	+16.0	+15.0	−1.0
5000	+13.8	+12.1	−1.7
6000	+10.7	+ 8.9	−1.8
7000	+ 8.0	+ 5.5	−2.5

samples gave promise of higher transmission because the peak at 2.7 μ was almost double that of the Reeves. These have not been tested yet with actual frequency film recordings. On the other hand, one of the Reeves stripes which uses a special binder to make it adhere better to the emulsion side of the film showed almost no transmission whatever. This suggests that the transmission properties depend on the molecular structure of the binder rather than upon the magnetic oxide itself.

Effect of Stripe on Level and Frequency Characteristic of Optical Track

Numerous tests were made to determine as accurately as possible the effect upon the level, frequency characteristic, distortion, and noise of the optical track when completely covered by a magnetic stripe. These tests were handicapped by the fact that the JAN projector is definitely not a laboratory instrument, and therefore does not always give entirely consistent results when used for laboratory measurements. With this reservation in mind, the following information is summarized from considerable accumulated data:

An SMPTE 16mm Frequency Test Reel, Serial #1048, was carefully measured on JAN Projector, Serial #164, which was the projector on which the infrared transparency effect was first discovered. It was then covered with a 100-mil Reeves stripe on the base side and measured once more. The results are shown in Table I.

From Table I it may be concluded that with the particular Reeves stripe used (which was the regular material supplied for base-side striping), the level loss at frequencies up to 1000 c is practically constant at 11 db. Above this frequency the loss increases slowly up to 13.5 db at 7000 c, or a net loss in frequency response of only 2.5 db. The 11-db loss in level, while certainly not desirable, is not very serious with the

Table II. Effect of Magnetic Stripe on Level, Distortion and Noise.

	Before striping	After striping
Level output at 400 cycles	+20 dbm	+9 dbm
Total harmonic distortion at 400 cycles (100% mod.)	3.1%	3.4%
Signal-to-noise ratio	47 db	36 db

lead-sulfide cell which has inherently at least 10-db better signal-to-noise ratio than the caesium cell. Besides, as indicated above, there is good reason to hope that this loss can be substantially reduced by proper selection of binder material, as well as by improvements in the exciter lamp and photocell characteristics. The fact remains, as proved by the demonstration film accompanying the presentation of this paper, that excellent optical recording quality can be obtained without any change in existing equipment.

The loss of 2.5 db in relative frequency response at 7000 c is obviously not serious. It can, moreover, be compensated by refocusing of the optical system for infrared light, as will be shown later. No refocusing was done, however, on the projector used for the demonstration.

Effect of Stripe on Harmonic Distortion and Noise of Optical Track

While it was obvious that excellent sound quality was being obtained from the completely covered optical tracks, nevertheless, it was decided to make actual harmonic distortion and noise measurements. This was done by recording long sections of 400-c test tone at 100% modulation, as well as biased unmodulated track. These were carefully measured on the JAN projector before and after applying the magnetic stripe, and the results are shown in Table II.

It should be pointed out that the distortion measurement is *total* harmonic distortion and, therefore, includes noise. This would explain the slight increase in distortion from 3.1% to 3.4% after applying the stripe. It might also be pointed out here that distortion measurements, like frequency measurements, are not always consistent on JAN projectors because of the tendency of some lead-sulfide cells to become nonlinear at the light levels presently used. On some projectors the distortion can be lessened by reducing the amount of light reaching the cell, so that the addition of a magnetic stripe might be expected to reduce the distortion. This was actually found to be true on one projector tested, in which the distortion went down from 3.6% to 3.2%.

The signal-to-noise ratio went down 11 db from 47 to 36, as might be expected, since the reproduced level from the track also went down 11 db after application of the stripe. If the loss of level could be compensated by increasing the amount of infrared light rather than by increasing the amplifier gain, both the distortion and noise would probably be less affected. This will be discussed again later on.

For the time being, it should be borne in mind that, when using regular caesium cells, the application of a conventional half-width magnetic track probably reduces the signal-to-noise ratio of the optical track by at least 6 db, so that the net loss due to completely covering the optical track is only 5 db when using a lead-sulfide cell, even without the possible improvements which will be discussed later.

Effect of Stripe on Focus of Optical System

It was pointed out, above, that the application of a magnetic stripe caused a relative loss of approximately 2.5 db in frequency response at 7000 c. This was true for the so-called standard emulsion position, i.e., when the emulsion side of the film is toward the sound lens and the magnetic stripe is applied to the base side of the film (Fig. 2).

In subsequent tests, which were made to compare the effects of base-side vs. emulsion-side stripes, it was observed that the high-frequency loss due to the stripe was always less when the stripe was applied to the emulsion side, which is necessary when the film is in the nonstandard emulsion position, i.e., when the base side of the film is toward the sound lens (Fig. 3).

This can be explained by the fact that only infrared light can penetrate the stripe. Since the sound optical system is not corrected for infrared light, the focal plane for such light is somewhat further from the sound lens than it is for white light. (This is shown in somewhat idealized form in Figs. 2 and 3.) Therefore, if the lens is properly focused on the emulsion side of the film for white light, it will be slightly out of focus after a magnetic stripe is applied. But, when a film in nonstandard position is run on this same projector, the optical soundtrack is already slightly out of focus for white light. When a magnetic stripe is now applied the infrared focus becomes effective, and since it is closer to the emulsion side than was the white light focus, the frequency response is improved.

Actually, it is recommended practice on 16mm projectors to focus the optical system midway between the base and emulsion side, so that the frequency response is not affected by the emulsion position. One test with striped film was made on such a projector and it was found that there was actually a gain of a fraction of a db at 7000 c when the stripe was on the emulsion side.

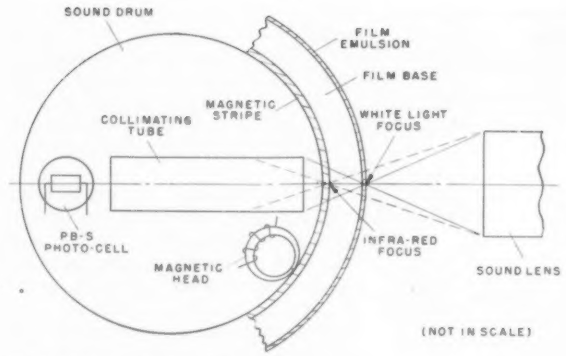

Fig. 2. Standard emulsion position.

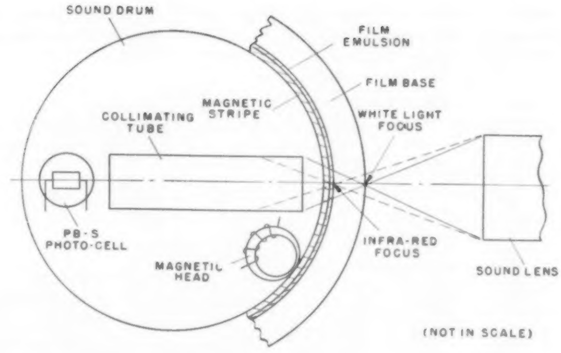

Fig. 3. Nonstandard emulsion position.

From a practical standpoint, however, it may be concluded that the effect of the stripe upon focus is, at worst, not serious and if the use of fully covered optical tracks should become general, it will be a simple matter to refocus permanently for infrared light.

Effect of Age of Oxide Mixture on Level and Frequency Response of Optical Track

Numerous tests were made to establish the effect of the age of the oxide mixture at the time of its application to the film. Because of the relative newness of the discovery the maximum period covered is only four months. That is, the oldest mixture tested was five months old and the newest was one month old. These tests were undertaken in an effort to explain the slight discrepancies noted at various times in relative frequency response and absolute level loss.

The results are shown in Table III. They do not definitely prove any specific trend as to age, but they do confirm that the minimum high-frequency loss is encountered when the stripe is on the emulsion side. The absolute level loss is also a minimum for this condition.

No explanation can be offered for the plus signs in the first column for Stripe A, as they apparently indicate that the striping loss is slightly less at 1000 to 3000 c than it is at 400 c. The readings at 3000 and 5000 c in the last column for Stripe B are also questionable as they indicate slightly higher striping loss than for 7000 c. All readings, however, were repeated several times to rule out the possibility of observational error.

It is felt, in general, that the discrepancies are not serious for 16mm work, and that it is reasonably safe to conclude at the present time that the age of the oxide mixture is not an important factor.

It should be emphasized that all of the oxide mixtures used in these tests, both on the base and emulsion sides, were of the same formula. Only the aging before application was varied. No readings are given for the special mixture designed for improved adhesion to the emulsion side since, as indicated earlier, this mixture had very little transmission. The level loss was over 30 db so that frequency readings were meaningless.

Uniformity of Transparency Effect on Various Projectors

Unfortunately, it is not very convenient to change photocells on the JAN projector, since this requires a partial disassembly of the sound unit. For this reason the transparency effect has not been tested for uniformity on a large number of cells. Instead, the effect has been tested on a number of different JAN projectors simply by running a test reel and listening to the quality of the optical track.

To date, 12 projectors have been tested in this way. On 6 of these the effect was highly satisfactory and the level loss was uniform at about 11 db. On 3 others the quality was good but the level loss was about 16 db. On the remaining 3 the level loss was about 20 db and there was a distinct swishing of background noise with the modulation. Since all of these projectors tested normal on conventional soundtracks and had equal output levels, it is a fairly safe assumption that the inconsistency is in the infrared characteristics of the lead-sulfide cell. This points up the need for tightening the specifications of the cell in this respect.

Possible Use on 35mm Equipment

All of the work described so far has been done with 16mm film on the JAN projector. An equally important application of the transparency effect would be in 35 mm work, especially as an improvement over the current type of "Mag-Optical" CinemaScope print which was designed, for economic reasons, to be usable interchangeably in all theaters, whether equipped for stereophonic magnetic reproduction or single optical track.

This is accomplished at present by first printing a 100-mil optical track in the normal position. This necessarily cuts down the width of the picture by approximately 73 mils. Then the four magnetic stripes are laid down, with the #2 stripe covering the outside (sprocket-hole) half of the optical track. The inside half which remains necessarily yields 6 db lower level than a normal track besides imposing severe requirements on the magnetic stripe as to accuracy of width and placement.

At least two methods of using the transparency principle to advantage here suggest themselves. One would be to make the #2 stripe twice as wide, thus improving its quality and making its application less critical, and at the same time permitting reproduction of the full-width optical track. The other would be to use only the covered half-width optical track and regain the full width of the picture.

Any use of the transparency principle, however, would necessarily require the substitution of a lead-sulfide cell for the caesium cell used in present theater equipment. Indications are that this need not be an elaborate conversion.

Experimental Conversion of 35mm Reproducer

One test conversion has already been made on a Westrex RA 1251 35mm rerecorder. A standard lead-sulfide cell was fitted with a simple condensing lens to concentrate the light down to the approximate $\frac{1}{8}$ by $\frac{1}{8}$-in. area of the sensitive surface. A base to match the regular caesium cell socket was provided and the unit simply plugged in. No change in either equalization, circuitry, or polarizing voltage was made. It was found that actually too much light was available as there was a gain of 20 db and some evidence of overload. The light was reduced by the simple expedient of inserting a piece of tissue paper in front of the cell so that the net gain was only 10 db. The Academy Standard Theater Test Reel, which contains both variable-area and variable-density recordings was run on this setup and found to give excellent quality.

It is realized that this is only a preliminary test and that further tests should be made including color film and actual measurements of distortion and

Table III. Effect Upon Level and Frequency Response of Optical Track of Various Ages of Oxide Mixtures, Applied to Base or Emulsion Side of Film.

	Rel. Effect of Stripe on Base Side			Rel. Effect of Stripe on Emulsion Side	
Freq.	Stripe A	Stripe B	Stripe C	Stripe A	Stripe B
400	0	0	0	0	0
1000	+1.5	−0.8	+0.4	−0.7	−0.5
2000	+1.3	−1.2	−0.5	−1.0	−0.9
3000	+1.3	−1.5	−1.3	−1.5	−1.7
5000	−0.7	−2.6	−2.8	−1.7	−1.1
7000	−1.8	−4.2	−3.0	−1.8	−0.8
Actual level loss at 400 C	12.5	11.0	12.0	10.0	10.5

Stripe A, 1 month old; Stripe B, 3 months old; and Stripe C, 5 months old.

frequency response. It is also pointed out that a magnetic stripe over the track has not been tried as yet, although it is not anticipated that this will behave any differently than with 16mm film. The important thing is that it indicates that conversion from caesium to lead-sulfide cells probably would not be an insurmountable problem.

Additional Tracks Without Additional Space

It may be observed here that the presence of an optical track underneath the magnetic stripe does not increase the space requirements whatever. The two tracks literally occupy the same space at the same time and yet are capable of carrying two entirely independent recordings. Conceivably, if the need should ever arise it would be possible to have an optical track underneath each magnetic stripe, resulting in as many as 8 independent tracks on CinemaScope prints, or even 12 in the case of 70mm Todd-A0 prints. One interesting possible application for the transparency principle which has been suggested is to provide two or more separate languages simultaneously for multiplex TV transmission or for providing the option of two or more languages in drive-in theaters.

Description of Demonstration Film

A 16mm demonstration film was run as part of the presentation of this paper. Since this film and the manner of its presentation were actually an integral part of the paper, the description which accompanied it is repeated here.

The film was projected on a JAN projector equipped for reproduction of either optical or magnetic soundtrack. It was fitted with the Max Kerr Aperture which had been described in an earlier paper.[7] This made it possible for the audience to see the full soundtrack area on the screen. Thus the degree to which the optical track was covered by the improperly placed stripe was clearly visible. When the optical track was completely covered this area became opaque so there could be no question that the "invisible" soundtrack was actually being reproduced by infrared light.

The first portion of the reel was a direct-positive recording of some high-fidelity music which made it clear that excellent quality could be obtained from a completely covered optical track. This was then rewound and the magnetic track, containing an entirely different recording, was reproduced to demonstrate that it was a normal magnetic stripe capable of recording excellent quality.

The next portion was an excerpt from the actual print on which the infrared transparency effect was first discovered. It was visually apparent that the misplaced half-stripe was permitting only occasional high-level peaks to be seen while the rest of the modulation was completely covered; nevertheless, fairly good sound quality was heard. This was followed by another excerpt from the same film with the soundtrack completely covered. While the level from this portion was slightly lower, the quality was better since there was now no change of linearity between the low- and high-level modulation.

The next portion of the reel contained two excerpts of films, which had full-width (100-mil) stripes of the Minnesota Mining laminated type, to demonstrate that it was just as transparent to infrared light as the Reeves solvent-type stripe. The first excerpt had the optical soundtrack in the nonstandard position so that the laminate was directly on the emulsion side of the film, as was illustrated in Fig. 3 above. The second excerpt also had the optical track in nonstandard position, but the laminate was on the base side of the film so that the light had to penetrate the oxide before coming to a focus on the soundtrack. These two excerpts demonstrated that excellent optical sound quality was obtained either way.

The remainder of the reel consisted of a number of identical optical frequency films arranged to permit testing of various oxide mixtures on both base and emulsion sides of the film. These had been used to obtain the various data presented in this paper. The magnetic stripes were then recorded with high-fidelity music as a check on their magnetic qualities. It might be reiterated here that the special oxide mix designed for use on the emulsion side, while it gave excellent adhesion to either side of the film, as well as excellent recording quality, had practically no infrared transmission.

Further Research Required

While it is hoped that this paper has amply demonstrated that it is feasible to reproduce optical soundtracks with excellent quality, after they are completely covered by magnetic stripes carrying independent recordings, it is important to emphasize that considerable research remains to be done if the transparency effect is to be improved and standardized. Various avenues of research are itemized below:

(a) Improved Infrared Photocells

The transmission curve shown in Fig. 1 indicates that the transmission between 4 and 5 μ is considerably greater than it is between 2 and 3 μ. Yet this area is completely wasted with the present lead-sulfide cell. If a cell could be developed with maximum sensitivity between 4 and 5 μ, the present loss of approximately 11 db could be greatly reduced. Anderson and Pakswer have shown that the peak of sensitivity can be shifted by altering the amount of lead oxide in the cell.[5]

There is also room for improvement in the uniformity of the cells. It has been observed that many cells show poor sensitivity to the transparency effect. It is not known as yet whether this is due to variation in their infrared response or other causes. Other cells, on the other hand, are sensitive to the transparency effect but show high distortion when used in the conventional manner. This is obviously a matter for investigation by the cell manufacturers.

(b) Improved Exciter Lamps

The tungsten radiation curve shown in Fig. 1 indicates that a good deal of the radiated energy is wasted on the lead-sulfide cell even when conventional soundtracks are used. This is because the tungsten lamp was designed to work with the caesium cell — or vice versa. When it is desired to transmit through magnetic stripes, the system becomes particularly inefficient. The least that should be done is to design a lamp whose radiation corresponds to that of the present lead-sulfide cell. Cashman[4] described an indirectly heated exciter lamp for this purpose in 1947, and Anderson and Pakswer[5] stated that work was being done on such lamps in 1949, but apparently the project was never completed, probably because the high sensitivity of the lead-sulfide cell gave it an advantage over the conventional caesium cell anyway, even with the conventional lamp.

Now that the discovery of the transparency effect demonstrates the desirability of utilizing the 4–5 μ region, there should be an added incentive to

develop a lamp which would yield high output in this region. Such a lamp in conjunction with a cell optimized for the same region would yield much higher output levels, and might permit a reduction in amplifier gain which would still further improve signal-to-noise ratio. Such a lamp, moreover, would probably have a much longer life than tungsten, and as Cashman[4] has pointed out, would not require r-f or d-c excitation as do conventional lamps to minimize a-c hum.

If it should be found that the region between 4 and 5 μ is too remote to work with the present optical system, substantial improvement in performance could still be obtained by at least designing a cell and lamp combination to peak at 2.7 μ at which point all of the stripes tested to date have a substantial peak.

(c) Study of Transmission at Longer Wavelengths

The spectrographic studies made so far have all stopped at 5 μ because of test equipment limitations. It would appear worth while to explore the longer wavelengths, at least up to the point where the optical track begins to lose contrast. Such wavelengths would, of course require optical systems of material other than glass or quartz. Arsenic trisulfide has been suggested as a suitable material at wavelengths up to 13 μ.

(d) Improved Transmission of Magnetic Stripes

The manufacturers of striping material may find it worth while to make more detailed study of the transmission characteristics of their product. The fact that the discovery of its infrared transmission came somewhat as a surprise suggests that possibly the oxide mixture and binder can be modified to transmit at shorter wavelengths as well. Perhaps the author's tongue-in-cheek suggestion in 1952 of a visually transparent magnetic oxide may turn out to be practical after all. In the meantime, it is hoped that the disclosure of the infrared transparency effect will result in some immediate applications and provide the incentive for further research and eventual standardization.

Ackr wledgments

The author wishes to acknowledge the cooperation of many people who helped in the preparation of this paper and demonstration film. Thanks are due especially to Edward Schmidt of Reeves Soundcraft for the oxide samples and spectrographs; to Malcolm Townsley of Bell & Howell, W. W. Wetzel of Minnesota Mining & Mfg. Co., and T. C. Bagg of the National Bureau of Standards, for collaborating in preparing the chart (Fig. 1) showing the spectral characteristics of the system; to Joseph D. Aiken and Jack Greenfield of the Naval Photo Center, for the loan of their magnetic-optical JAN projector and assistance in obtaining necessary data; and to E. W. D'Arcy of D'arcy Magnetic Products, Inc., who was one of the pioneers of the JAN projector and its magnetic adaptations, and who encouraged the preparation of this paper. Thanks should also go to Max Kerr, formerly of the Bureau of Ships, who pioneered the special aperture plate which made the demonstration film so much more effective; to Specialist Loren Steadman of the Army Pictorial Center, who assisted in the preparation of the magnetic recordings and to William Youngs, of the U.S. Information Agency, who volunteered his services as projectionist for the entire Convention and rendered valuable assistance in setting up the demonstration film. The assistance of Steve Szeglin of Army Pictorial Center in making the first adaptation of a lead-sulfide cell to a 35mm reproducer is especially appreciated; also that of Garland C. Misener of Capital Film Laboratories, who made many suggestions and provided the samples of Minnesota Mining laminated prints.

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Richard F. Dubbe, "Recent developments in magnetic striping by the lamination process," *Jour. SMPTE, 64:* 378–379, July 1955.

Discussion

Ellis W. D'Arcy (Session Chairman): I might say that this opens the way for a new era in two-track sound film and provides additional justification for our recommendation of 28-frame separation which permits simultaneous scanning of optical and magnetic tracks.

Could Mr. Lester (who gave the paper "Progress With Transistors," June 1957 *Journal*) advise what type of transistor could be recommended for use with Mr. Lewin's proposed system?

Burton R. Lester (General Electric Co.): I would recommend immediately testing some of the solar cells which are being sold for use. I believe that there are some portable radios out now using them as a power supply. These are small photocells which will eventually be quite inexpensive, though they now are about $10.00.

Mr. D'Arcy: What frequency range can we expect from solar cells?

Mr. Lester: The large size is going to be limiting — it's made large now, about the size of a quarter so that would cut down its frequency; but smaller sections could be made which would have frequency response certainly up to the order of 15 to 20 kilocycles.

Col. Richard H. Ranger (Rangertone, Inc.): Mr. Chairman. This paper surely is a milestone in the work of this Convention. It is a definite break away from our thinking in optical and magnetic soundtracks. May I suggest that we give George Lewin a rising vote of appreciation for his presenting us with the results of this discovery so completely and so quickly.

[The entire audience rose and warmly applauded the speaker.]

Further Comment From Col. Ranger by Mail

In carrying on further work with the combined optical and magnetic tracks as proposed by George Lewin, we have noted that optical dye tracks are no good at all for overstriping with a magnetic track. The dye evidently blocks the infrared quite completely.

Variable-area recording is also much better than variable-density as far as distortion in the optical playback is concerned. The new silver track color film is excellent and prints from internegatives seem to have a bit of an edge on the straight negative-positive for color prints.

George Lewin (by mail): While I have not had the opportunity to check the transparency effect on dye tracks (and I assume that Col. Ranger is referring here to all-dye, unsulfided tracks), I disagree only with his explanation of the reason for the failure. Dye tracks are too transparent rather than too opaque to infrared, resulting in a severe loss of contrast — hence loss of level as well — when reproduced with lead sulfide cells. This has been one of the principal objections to the more general use of these cells. When such a track is covered with a magnetic track, the additional loss would understandably make it completely unusable. Fortunately, this type of track is disappearing from use, as it is not very satisfactory even with a conventional caesium cell. Sulfided dye tracks, as well as dye-plus-silver tracks, are much more satisfactory, and work quite well when covered by magnetic stripes.

As to the higher distortion in variable-density tracks as compared to variable-area, Col. Ranger is probably correct. I have no data on 16mm variable-density as yet, but in the limited tests made with 35mm film I have found that a track measuring 4% intermodulation distortion on a caesium cell measures 8% on a lead-sulfide cell. However, 8% is by no means bad for intermodulation, and as stated in the paper, actual listening tests with the Academy Theater Test Reel, revealed no appreciable difference in quality between the two types of track when reproduced with a lead-sulfide cell. These tests were made with regular tracks — not covered with magnetic stripes, but it is hoped that the addition of the stripe will only reduce the level and not increase the distortion appreciably.

There is no question that there is room for improvement in the lead-sulfide cell, and I should like to add to the indicated avenues of research listed in the paper above, the suggestion for a more thorough study of the effect of the lead sulfide cell upon the overall gamma of variable-density tracks, along the lines suggested by Dr. Frayne in the discussion which followed the R. W. Lee paper listed in the references. It is felt that the manufacturers of the cell should take a more active interest in this matter than they have in the past, especially since the discovery of the transparency effect seems to open up a field for much greater usage of these cells.

A SERIES OF SEVEN PAPERS ON STANDARDS AND STANDARDIZATION

Report of the Standards Committee

By GLENN L. DIMMICK

This report describes the activities of the SMPTE Standards Committee with an analysis of product emphasis presently existing in Standardization

During the period from January 1, 1956, to April 29, 1957, 49 separate Standardizing actions were originated in the SMPTE Engineering Committees and are in various stages leading to final approval as ASA Standards. It is the purpose of this brief report to classify these actions in two ways.

First, the actions will be broken down in the number originated by each Engineering Committee to indicate those that are still in Committee, those that are in process of becoming Standards, and those that are approved ASA Standards. A second way of classifying the various standardizing actions is to indicate the number that have been originated in relation to different kinds of equipment and processes used in the motion-picture industry.

Of the 49 separate standardizing actions, 14 were originated by the Sound Committee under the chairmanship of L. D. Grignon. Five of these are still in the Engineering Committee, 5 are in process of becoming Standards, and 4 have been approved as ASA Standards.

Eleven standardizing actions originated in the 16- and 8mm Committee under the chairmanship of R. E. Birr. Four of these are in the Engineering Committee, 4 are in process of becoming Standards, and 3 have been approved as ASA Standards.

Eight standardizing actions originated in the Film Dimensions Committee under the chairmanship of W. G. Hill. Four of these are in the process of becoming Standards and 4 have been approved as ASA Standards.

Seven standardizing actions originated in the Film Projection Practice Committee under the chairmanship of Willy Borberg. Six of these are in process of becoming ASA Standards, and one has been approved as an ASA Standard.

Four standardizing actions originated in the Laboratory Practice Committee under the chairmanship of Vaughn C. Shaner. Two of these are in the Engineering Committee, and 2 are in the process of becoming ASA Standards.

Two standardizing actions originated in the Television Committee under the chairmanship of T. Gentry Veal. Both actions are still in the Engineering Committee.

One standardizing action originated in the Screen Brightness Committee under the chairmanship of Fred J. Kolb. This action is still in the Engineering Committee.

One standardizing action originated in the High-Speed Photography Committee under the chairmanship of R. O. Painter. This action is in the process of becoming an SMPTE Recommended Practice.

One standardizing action originated in the Color Committee under the chairmanship of J. Paul Weiss. This action is still in the Engineering Committee.

To summarize, 9 of the 13 Engineering Committees were responsible for originating the 49 standardizing actions. Within the period noted above, this resulted in 12 approved ASA Standards. Twenty-two more have passed the Engineering Committee action and are in the process of becoming ASA Standards. Fifteen are still in Engineering Committees.

It is of interest to know the degree of emphasis that has been placed on various kinds of equipment in originating the actions leading to standardization.

Twelve of the 49 standardizing actions had to do with sound. Three of these related to optical sound systems and 9 to magnetic sound systems.

Ten of the standardizing actions had to do with projectors. Six of these related to 35mm projectors, 2 to 16mm projectors, and 2 to 8mm projectors.

Eight standardizing actions had to do with film dimensions. Four of these related to 35mm film, 2 to 32mm film, and 2 to 16mm film.

Eight standardizing actions had to do with cameras. One of these related to high-speed cameras, one to 35mm cameras, 3 to 16mm cameras, and 3 to 8mm cameras.

There were also these standardizing actions: 4 to do with screens; 3 to do with test film; 2 to do with printers; and 1 each to do with safety film and with density measurements on color film.

From the above it may be seen that the Sound Committee is the most active committee at the present time and that two-thirds of this activity is centered upon magnetic sound systems. It also appears that the greatest standardizing activity relates to 4 kinds of equipment, i.e., sound, projectors, film and cameras.

In concluding this report I would like to thank Peggy Legakis for her valuable assistance in supplying the data from the SMPTE records.

Discussion

Ellis W. D'Arcy (D'Arcy Magnetic Products, Inc.): Has there been any activity on magnetic video recording standardization?

Mr. Dimmick: There has been no standardization activity in video recording; however, in view of the work that is going on in both photographic and magnetic video recording, I would expect committee action in the near future.

T. Gentry Veal (Eastman Kodak Co.): At the committee meeting in Hollywood last year, Axel Jensen and several others were wondering whether this was a matter for the SMPTE, RETMA, NARTB or several of the other societies. The tentative plan was to form a committee made up of one member from each of the various societies to decide how this should be handled.

Mr. Dimmick: We hope that this committee is formed and that it takes effective action to assure that there will be appropriate standards covering the important field of magnetic video recording.

Presented on April 28, 1957, at the Society's Convention at Washington, D.C., by Glenn L. Dimmick, Chairman of SMPTE Standards Committee, Bldg. 10-8, Radio Corp. of America, Camden 2, N.J.
(This paper was received on July 9, 1957.)

Do Standards Inhibit Progress?

By J. W. McNair

For many years one of the slogans of the American Standards Association has been "Standardization is dynamic, not static. It means not to stand still but to move forward together." The paper examines the procedures of the ASA and shows how the Association provides for periodic review of American Standards so that they do not become "stale" or stand in the way of progress. Examples of such standards in the motion-picture field are given.

The question of whether or not the standardization process, and the approved standards resulting from it, inhibit progress is one which has engaged the attention of those concerned with standardization work from the very start of the standardization movement in the United States.

At the Spring Convention of your Society in 1933 in New York, the late Dr. Paul G. Agnew, for more than thirty years Secretary of the ASA (and certainly one of the outstanding thinkers in the standardization movement in the United States), presented a very comprehensive paper entitled "National Standardization in America."[1] In the course of his paper Dr. Agnew said:

"There is a widespread but erroneous opinion that the primary difference between a standard suitable for approval as an American Standard and one that should remain a society or association standard is the length of time which is liable to elapse before revision becomes desirable. As a matter of fact, this is a wholly secondary matter. When the ASA was first organized a provision was inserted in the procedure preventing the revision of an American Standard more frequently than once in three years. Experience at once showed that any such provision was wholly unnecessary and unworkable. The real question is whether industry finds the standard a workable and useful tool. Whenever additional information, new developments, or changing conditions in the industry make it desirable, a revision should be promptly carried through in order that the standard as a tool shall at all times have a good cutting edge. From the point of view of utility (which is the only reason for setting up a standard) it is immaterial whether a standard be revised in one year or in ten years. Revision should be made when, and only when, conditions make it desirable to resharpen the tool. The National Electrical Code, which is one of the most widely used American standards, is regularly revised once every second year in order to keep abreast of developments.

"It is the business of a gyro-stabilizer to keep the ship on an even keel when it is being buffeted by waves, not to stop the ship. Just so it is the business of a successful standard to help industry to maintain itself in *dynamic equilibrium*, not in a *static* condition. The ASA has for years carried the following statement on the title page of its Year Book:

"*Standardization is dynamic, not static. It means not to stand still, but to move forward together.*"

Over the years, continuous thought has been given to the matter of reviewing standards within the ASA, particularly by the ASA's Rules Committee which is called the Committee on Procedure. Section B4.2 of the ASA's By-Laws now reads:[2]

"At least once in every five years (the Standards Boards responsible shall) consider the standards under their jurisdiction, and request sponsors or sectional committees in charge to review the standards with a view of reaffirmation or revision."

The sectional committees on photography, and, in particular, the PH22 Sectional Committee on Motion Pictures, sponsored by your Society, have been so diligent in this respect that a reminder from the Photographic Standards Board is never necessary.

In the ASA publication, *The Organization and Work of ASA Sectional Committees*, the following is given with respect to *revision of standards:*[3]

"Standards are industrial tools and should be kept in step with technological developments. It is, therefore, desirable for committees to maintain a continuing interest in the standards prepared under their supervision and to review them at periodic intervals. So as to insure this review, the ASA By-Laws require such a review at least once in every five years with a view to reaffirmation or revision."

As will readily be seen from the above, the fundamental documents of the ASA foresee, and in fact require, that standards should be studied periodically by the committees and organizations directly responsible for them. In this way they will not become "stale," get out of step with scientific and industrial advancements, nor be in a position to inhibit progress. If standards were allowed to become obsolete they would be a hindrance to those in the industry concerned with them.

Human factors are perhaps the most important considerations which stand in the way of prompt and orderly revision of standards when needed. A natural reluctance to change the old established and well-understood standards, coupled with the factors of just plain "human cussedness," are things which must constantly be kept in mind. The fundamental documents of the ASA make continual reference to the responsibility of all of the organizations participating in national standardization work to be alive to all of their duties and see that progress is reflected in both new and revised standards when conditions so indicate.

Most of you are familiar with the volume *National Standards in a Modern Economy*,[4] edited by the late Professor Dickson Reck of the School of Business Administration, University of California. This volume is dedicated to Dr. Agnew and a paragraph therein on *revision of standards* is worthy of quotation. It was contributed by Simon Collier, Director of Quality Control for the Johns-Manville Corp.

"It is important that any specifications system be adaptable to change so that standards may be revised to meet current needs. Specifications should not be static but constantly reviewed to meet the ever-changing conditions imposed on the system. The future always offers better and more economical means of accomplishing the task and industry must gear itself to these changing conditions. In order that the system not fall into a state of chaos, there must be a formal procedure for the revision of all standards in accordance with the desires of top management. The dissemination of the approved changes through the specifications system insures notification to those most vitally concerned."

Now, let us examine how standards are kept dynamic. On April 1, 1957, 1680 standards had been approved by the ASA as American Standard. A review of the approvals in the last seven years shows the following breakdown between "New Standards Approved" and "Revised Standards Approved":

Year	*New Standards Approved*	*Revised Standards Approved*
1956	108	214
1955	154	80
1954	64	96
1953	78	177
1952	84	120
1951	119	98
1950	43	73

Presented on April 29, 1957, at the Society's Convention at Washington, D.C., by J. W. McNair, American Standards Association, Inc., 70 E. 45 St., New York 17.
(This paper was received on April 18, 1957.)

In the field with which you are most concerned — motion pictures — 89 standards were approved as American Standard as of April 1. This was a direct result of the efforts of the PH22 Committee and its sponsor, the SMPTE.

The first standards in the motion-picture field approved by the ASA go back to the year 1930, when a small pamphlet of standards was approved as American Standard. In 1935 additional standards in the 16mm field were approved. In 1941, a wholesale revision of motion-picture standards was carried out and each of the standards approved until that time was given its own individual designation number. You are all familiar with the Z22 Series (now the PH22 Series). Starting with the year 1941 as a base, 36 motion-picture standards have been revised *twice* and 18 have been revised *three* times. This certainly represents active work and continued attention to the problem of keeping standards up to date. The SMPTE is to be complimented, as well as all of the organizations represented on the PH22 Committee, for its endeavors along these lines. Time does not permit mentioning all of the organizations concerned, but it is only fair that the Motion Picture Research Council receive its share of the credit.

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The International Standards Organization and Cinematography

By DEANE R. WHITE

Plans of the International Standardization Organization with reference to the selection of items suitable for standardization are presented. Also discussed are how ISO actions will affect American equipment manufacturers and film products, and what safeguards exist.

THE VALUES of standards as an aid, rather than a hindrance, to progress are discussed in the previous paper. A review of the history of standardization activities shows that the need for standards in many fields on an international rather than a national basis has been recognized for over fifty years. The International Standards Organization was created after the conclusion of the hostilities of World War II. It is the outgrowth of activities of the United Nations Standards Coordinating Committee, and plans for its creation received approval from enough national bodies so that its official life started on February 23, 1947.

Participation in the work of this organization has continued to spread since that initial date and today it has a broad base both in scope of technical subjects covered and in national bodies represented. It should be noted, however, that the scope of the ISO is not universal. For example, standardization in the electrical field is specifically the concern of the International Electrotechnical Commission which has a longer history of activity in its own field and in its own right.

The International Standards Organization is made up of national member bodies chosen to represent participating nations. In some countries these national bodies are part of the government of the country, whereas in other countries they are nongovernmental standardizing units which have grown to national stature. The latter situation is the case here where the national body is the American Standards Association, which officially represents the United States in the standardizing activities of ISO. The financial support for ISO comes from the national bodies of which it is composed and, accordingly, the American Standards Association pays a portion of the cost of the International Standards Organization. As I see it, this contributes much in reaching the international field with some of the theory and doctrines of voluntary cooperation with which we are so familiar in our national standardizing activities.

The technical work of standardization is in the hands of Technical Committees created by the ISO from the member bodies which express active interest and desire to participate in a given field. The scope of work for the committee is set up to indicate the activities appropriate to it and to differentiate them from, and coordinate them with, activities of other committees working in related fields. Nations with particular business interest in a subject typically form the active center of the technical committee by becoming "Participating" members of that technical committee. Some national bodies feel that they have more than casual interest in a field, but that they are not in a position to carry on active work. In such cases an "Observer" membership may be chosen. These members are kept informed of progress more fully than national bodies which express no active interest in the field.

The organizational rules set up the duties and the responsibilities associated with the different degrees of interest and, of course, are so organized that the participating members of a technical committee are the key group, responsible for originating and controlling activities in their field. It should be noted, however, that the ultimate step open to the ISO, the adoption of an international standard, can be achieved only under the rules of the organization by the unanimous approval of all member bodies, regardless of their participation in the activities of a given technical committee. Thus, the interests of each nation are protected from the final adoption of an international standard with which that nation disagrees.

Experience has shown that there is much of value which can be gained in the process of exchange of ideas between nations and the development of thinking concerning technical problems of common interest. In some cases divergent views continue to diverge, but there are many cases where a common ground of understanding can be found covering material of considerable importance, even though the final scope may be more limited than originally anticipated.

The history of international standardizing activities in the photographic field

Presented on April 29, 1957, at the Society's Convention at Washington, D.C., by Deane R. White, Photo Products Dept., E. I. du Pont de Nemours & Co., Inc., Parlin, N.J.
(This paper was received on April 26, 1957.)

includes some work started under the auspices of the International Federation of the National Standardizing Associations, often referred to as ISA, which existed and carried out its work in the period from 1926 to 1942. Later, photographic standardization was included in the scope of the International Standards Organization and the international activities directed toward standardization in photography have been under ISO auspices since its creation.

The technical committee of greatest interest to the SMPTE is Technical Committee No. 36 whose field is cinematography. Our own American Standards Association, which is the official representative body for the United States, is the Secretariat of this Technical Committee. The eleven participating members are:

Belgium	Sweden
Czechoslovakia	Switzerland
France	Union of Soviet Socialist Republics
Germany	
Italy	United Kingdom
Netherlands	USA (Secretariat)

The above are the active working group. The remaining members of the committee are observer members, of which there are sixteen:

Australia	Japan
Austria	Mexico
Canada	Pakistan
Chile	Poland
Denmark	Portugal
Greece	Roumania
Hungary	Spain
India	Yugoslavia

In its capacity as Secretariat for Technical Committee 36, the American Standards Association must act as leader of the group. It must organize the diverse interests that led the different nations to join the Committee into effective progressive action. The Secretariat occupies a position of prime importance in framing, from the wide range of suggestion and comment which must be pieced together, an acceptable proposal or recommendation.

The national body holding the Secretariat of a technical committee has a dual role. When acting in its capacity as Secretariat, it should be completely impartial and see that all nations have the same opportunity to express their views and to have those views incorporated into proposals and recommendations. This must be done at the same time that it acts as a national body in its own right, expressing and protecting its own business interests.

The ASA has taken pains to meet the requirements of this dual character and, I believe, has been successful in maintaining the impartiality of the work of the Secretariat while at the same time clearly expressing our national views.

Committee PH22 of the American Standards Association, which has been active for years in standardization activities in the United States, has been assigned also the responsibility of determining the actions to be taken for the national interest in the field of international standardization. This Committee has behind it the series of national standards which show the areas where business importance and technical agreement have already led to national action. This Committee has received full cooperation from the Engineering Committees of the SMPTE and can thus keep abreast of current developments in the establishment of new standards or revision of old ones.

The program of work of a technical committee of the ISO is normally self-determined, so long as it stays within its assigned and agreed scope. The ASA, as Secretariat, has a major responsibility in organizing the work and has met this by canvassing the national member bodies for the subjects which they consider important. Here in the United States, our own standards have been reviewed from time to time and decisions reached concerning their suitability and importance for international consideration. In many cases the same reasoning which had led to the adoption of these as national standards showed valid reason for suggesting them in the international field. Since at times they were not universally applicable, not all of our national standards have been suggested for consideration. Other national bodies have suggested areas where international standards appear important to them. From these different sources evolves the program of work accepted by the International Committee.

The work of Technical Committee 36 has resulted in the adoption of seven ISO Recommendations dealing with emulsion and sound-record positions in cameras and projectors. Ten units are currently in circulation to all ISO member bodies as Second Draft ISO Recommendations and, if approved on this time around, will join the other seven as ISO Recommendations. After the previous circulation of these ten, need for further change and revision was apparent and it is the corrected version of each of these which is now in circulation.

Five Draft ISO Proposals are still in the hands of the Secretariat and the Technical Committee, and work is continuing to try to reconcile divergent views. When that is accomplished to the satisfaction of the Committee, they can be moved to the next step toward adoption as ISO Recommendations.

The last meeting of TC 36, at Stockholm in 1955, formed seven working groups, listed below, to continue activity in areas where there was international interest but where further work appeared necessary. Because of the breadth of our national interest in the field, we requested representation in each working group and made appointments for the U.S. as shown with the group memberships:

Film dimensions
United Kingdom (Chair)
Belgium
France
Germany
Sweden
USSR
USA — W. G. Hill

Luminance of screens
France (Chair)
Germany
United Kingdom
USSR
USA — F. J. Kolb

Reproduction characteristics of magnetic sound on perforated film
USA (Chair) — M. G. Townsley
France
Germany
Netherlands
Sweden
United Kingdom
USSR

Image areas for 16mm projector and camera apertures
Belgium (Chair)
France
Sweden
United Kingdom
USSR
USA — A. C. Robertson

Definition and marking of safety motion-picture film
Belgium (Chair)
France
Germany
Italy
United Kingdom
USSR
USA — J. M. Calhoun

Perforated films with magnetic striping
Germany (Chair)
France
Sweden
United Kingdom
USSR
USA — E. W. D'Arcy

Wide-screen pictures
Sweden (Chair)
France
Germany
Italy
United Kingdom
USSR
USA — W. F. Kelley

Progress has proven very slow and in no case has the United States representative found himself burdened by a deluge of mail coming to him. The groups have differed in their activity, but as an evaluative overall statement it is fair to note that no group has yet brought forth a proposal to the Secretariat, though typically such proposals were authorized at the Stockholm meeting. Though slower than anticipated, this interim work will show its value as preparation for the next meeting of TC 36 planned for 1958 in England.

I would like to draw particular attention to the importance of timing in these activities of international standardiza-

tion. Our own extensive efforts in the standardization field in cinematography place our views and decisions on record in a way that very strongly influences the plans and thinking of others. Such sound technical work gives the best approach to securing good international standards. The discussion of differences in technical views is best conducted in working groups between meetings or in working committees at meetings. In such early stages, reconciliation of diverse views is simpler than at any later stage. Corrections can be made later when necessary, but it is worth a great deal of effort to do the job well early in the game. Changes become slower and more difficult as the proposals are processed through the various steps of the international procedure.

The value of this work lies in the exchange of ideas in areas of business importance to us. In some cases we learn the problems facing other groups, and may be able to better adapt our products and procedures to their needs and wishes. This is one form of good salesmanship. In other cases the selection and designation of a preferred way of meeting a problem from several possible methods contributes to interchangeability, helpful to business.

A point of some importance in considering the future value of this work lies in the fact that, in a sense, the ISO is the standardizer's standardizer. That is, the ISO is an organization of national standardizing bodies, and as technological progress spreads to other nations and areas, it is anticipated that the results of today's international work will be adopted as a nucleus of proven standards by new national groups. This can be important in smoothing the growth of international business.

I hope that you see in this ISO work (1) the development of a way of meeting an old need in international business, (2) an opportunity for the ASA to serve our country well by the international aspects of its activities, and (3) the specific part that PH22 and the engineering committees of the Society have in furthering business by their activities in international standardization in cinematography.

Discussion

Glenn Dimmick (Session Chairman): It's quite apparent here that to get a real international standard is rather hopeless since it requires complete agreement with all parties. It wasn't quite clear to me how you arrive at a recommended practice.

Dr. White: The International Standards Organization has rules governing this but does not have the rule of unanimity that we use so effectively in our own national work and, to that extent, it is possible that an ISO recommendation can exist with which any given country is individually in disagreement. The major conclusion that I draw is this: the timing of this work is quite important to us because, where we have had good standardization work done ahead of time, there has been little hazard of the final standard not fitting well with our needs. If we do our homework well, we don't have to be afraid of the result.

The ISO recommendations are available to individuals or manufacturers only through national standardizing bodies. In other words, if you wish to know what an international ISO recommendation is, you should not write ISO at Geneva but you should write the American Standards Association in New York. They can give you the international recommendation and explain any reason for difference that exists between that and the national standard. In a sense, therefore, the international recommendation represents a distillation or meeting of minds which may be less than a complete unanimity but normally should be interpreted properly because of accessibility through the local standardizing groups.

Dr. Dimmick: When and how were the ground rules set up for ISO?

Dr. White: I can't answer that completely The United Nations Committee set up an organization plan which was to become operative when 15 nations had agreed to participate. The 15th nation agreed to participate on that date in February 1946 which I mentioned, and since then many more have come into the fold — I do not have the count; but the ground rules and procedures came through that path.

Boyce Nemec (Management Consultant, New York): Many of us in the Society look to the *Journal* quite regularly to tell us the status of engineering standards projects that are in work on motion pictures in the U.S. Dr. White just mentioned that if we want to know the status of ISO projects we should write to the ASA. I wonder if we might also look to the *Journal* to tell us perhaps once a year just what the status of these projects is?

Dr. White: I believe that is a legitimate expectation.

J. W. McNair (American Standards Association): I might add to Dr. White's remarks by saying that there are now 38 nations that are members of the ISO. This number includes all of the nations in Western Europe, the United States and Canada and, I think, two of the South American nations. It includes substantially all of the Iron Curtain countries, except China; and it's interesting that in 1955, at the meetings to which Dr. White alluded, we had for the first time some active technical participation by the USSR.

Now if I might say just a word about this business of international standards. When the ISO was started, and it did get started in 1946 as Dr. White pointed out, there was a certain group that was actively advocating the formulation of international standards and another stronger group that felt the ISO should be a coordinating body to coordinate national standards and not to issue international standards, so the rules were written in such a way that you could have international standards if you could get 100% unanimity. However, as of now, there are 37 approved ISO recommendations and nobody has ever tried to get an international standard. From what we can tell now, I don't think anybody will, because this procedure of having the recommendations issued and then having the nations that can do so coordinate their own standards is working very well. Of course I should point out that all of this is a voluntary business. There is no compulsion placed on us to adopt an international recommendation although the hope certainly is that each of the 38 nations will give due consideration to adopting the international recommendations.

Motion-Picture Standards in Canada

Abstract of CBC Operations Instruction Bulletin Number 30

For several years, the Canadian Broadcasting Corp. has been issuing within its organization a series known as Operations Instructions Bulletins. The Bulletin on Motion Picture Standards, issued in January 1957, is reprinted herewith in abstracted form, the omissions being indexes and lists which are already published by this Society and made available to members, usually at no charge.—Glenn E. Matthews, Editorial Vice-President; Axel G. Jensen, Engineering Vice-President.

The motion-picture industry over the past 25 years has achieved a high degree of standardization of equipment materials and practices. One of the main reasons for standardization is the extreme precision required to achieve satisfactory picture presentation in the theater.

It is not unusual to require magnification of 500 diameters of the picture images on theater screens. The images must be laid down successively on the screen at a rate of 24/sec to achieve smooth continuity of visual information. If the maximum vertical displacement of successive images on the screen is taken as 0.5 in., the tolerance in placement of the film frames in the projector gate becomes very small. When it is considered that placement of images on the screen may be affected by the register of the perforations in the original taking camera, as well as in intermediate stages between the original negative and final projection print, the shrinkage of the film itself and the perforating tolerances, it can be seen that the production of a technically perfect motion-picture print requires a high degree of perfection in film handling equipment and in the film material.

Organizations chiefly responsible for motion-picture standardization activities are: the Society of Motion Picture and Television Engineers, the Motion Picture Research Council and the American Standards Association in the United States; the British Kinematograph Society and the British Standards Institution in England; and the Canadian Standards Association in Canada. During the last war the U.S. Armed Forces published a number of joint Army/Navy (JAN) specifications. Many of these have been incorporated into ASA standards.

Abstract of Canadian Broadcasting Corp. Bulletin 30, published with the kindly consent of W. G. Richardson, Director of Engineering, and J. E. Hayes, Chief Engineer, Canadian Broadcasting Corp., Montreal, Que.; and through the good offices of Rodger J. Ross, Supervisor of Technical Film Operations, Canadian Broadcasting Corp., 354 Jarvis St., Toronto, Ont.

(The Bulletin then cites the availability of many standards which cover areas in which film is applied to television and lists 41 of the ASA PH22 series (approved or being revised). These are listed, along with other motion-picture standards, in the Index to American Standards and SMPTE Recommendations, in the annual indexes published in each of the recent December issues. The Index is available as a reprint at no charge.

(Then the Bulletin lists 27 other ASA Standards on photographic plates, papers, sensitivity, chemicals, processing, instruments and nomenclature. These will be found indexed among a total of upwards of 300 photographic standards in the catalog, American Standards Price List and Index, Spring 1956, No. 5601, available without charge from American Standards Assn., 70 East 45 St., New York 17.

(Listed below are the British Standards which the Canadian Bulletin noted as of special interest. A complete list of the British Standards is available from the British Standards Institute, 2 Park St., London, Wl. The British Standards yearbook is available from the American Standards Association at a price of $2.75.

586–1953: Photoelectric cells of the emission type for sound film apparatus
677–1942: Motion-picture films
850–1955: Definition of cinematograph safety film
1380–1947: Speed and exposure index of photographic negative material
1384–1947: Measurement of photographic transmission density
1488–1948: Test films for 16mm cinematograph projectors
1585–1949: 16mm cinematograph sound on film release prints
1613–1949: Resolving power of lenses for cameras and enlargers
1793–1952: Audio frequency transformers for cinematograph equipment
1988–1953: Measurement of frequency variation in sound recording and reproduction

(The Bulletin lists the following standards of the Canadian Standards Assn. A description of the organization and program of the Canadian Standards Assn., written by Gerald G. Graham, was published in the *Journal*, pp. 156–157, Aug. 1952. The address of the Canadian Assn. is: 235 Montreal Rd., Eastview, Ottawa; or P.O. Box 506 Weston, Toronto, Ont.

Canadian Motion-Picture Standards

Z7.1: Specifications for motion-picture photography
*Z7.1.1.1-1948: Cutting and perforating dimensions for 16mm silent motion picture negative and positive raw stock
*Z7.1.1.2-1943: Cutting and perforating dimensions for 16mm sound motion-picture negative and positive raw stock
*Z7.1.1.5: Raw stock cores for 16mm motion-picture film
*Z7.1.4.3-1948: Emulsion and sound record positions in camera for 16mm sound-motion picture film
*Z7.1.6.2-1948: Sound records and scanning area of 16mm sound motion-picture prints
*Z7.1.7.3-1948: Emulsion and sound record positions in projector for direct front projection of 16mm sound motion-picture film
*Z7.1.7.5-1948: Reel spindles for 16mm motion-picture projectors
*Z7.1.9.1-1948: Nomenclature for motion-picture film used in studio and processing laboratories
*Z7.1.6.3-1950: Specification for sound focusing test film for 16mm sound motion-picture projection equipment
*Z7.1.6.4-1950: Specifications for 3000-cycle flutter test film for 16mm sound motion-picture projectors
*Z7.1.6.5-1950: Specifications for multi-frequency test film for field testing of 16mm sound motion-picture projection equipment
*Z7.1.6.6-1950: Specifications for 400-cycle signal level test film for 16mm sound motion-picture projection equipment
*Z7.1.6.7-1950: Method of making intermodulation tests on variable density 16mm sound motion-picture prints
*Z7.1.6.8-1950: Method of making cross modulation tests on variable-area 16mm sound motion-picture prints
*Z7.1.7.10-1950: 16mm positive aperture dimensions and image size for positive prints made from 35mm negatives
*Z7.1.7.11-1950: Negative aperture dimensions and image size for 16mm duplicate negatives made from 35mm positive prints

* These are Canadian Standards which are American Standards *adopted without alteration*. The Bulletin gives this advice:

"It should not be assumed that due to similarity of titles, a Canadian Standard is a copy of the corresponding American Standard. In those cases in which the Canadian Standards Assn. has adopted an American Standard without alteration, that is stated in the standard."

*Z7.1.7.12-1950: Printer aperture dimensions for contact printing 16mm positive prints from 16mm negatives

*Z7.1.7.13-1950: Printer aperture dimensions for contact printing 16mm reversal and color reversal duplicate prints

*Z7.1.7.14-1950: Method of determining resolving power of 16mm motion-picture projector lenses

*Z7.1.7.15-1950: Method of determining freedom from travel ghost in 16mm sound motion-picture projectors

General Photographic Specifications

*Z7.0.2.1-1950: Diffuse transmission density

*Z7.0.2.2-1951: Standard method for determining photographic speed and exposure index

*Z7.0.2.4-1951: Spectral sensitivity indexes and group numbers for photographic emulsions

*Z7.0.3.1-1950: Standard definition of safety photographic film

*Z7.0.3.2-1951: Films for permanent records

Z7.0.4.1-1951: Standard method for determining veiling glare in photographic systems

*Z7.0.4.2-1951: Apertures and related quantities pertaining to photographic lenses

*Z7.0.8.1-1951: Practice for temperature of processing solutions

*Z7.0.8.7-1951: Permanency of the silver images of processed films, plates and papers

(The Bulletin next describes the technical and standards activities of the SMPTE, reporting, for instance, much that was in the August 1956 *Journal* Engineering Activities column, pp. 441–444.

(Twenty-one of the SMPTE test films are enumerated by the Bulletin which notes briefly the value of test films and slides in design, operation and maintenance. A Test Film Catalog is available from SMPTE headquarters, at no charge.

(The Society's *Journal* is described by citing the contents of one particular issue, August 1956, and further by listing some 75 articles of the past which have related to film and television. The Society has available from its headquarters, at no charge, a "Television Bibliography" which lists papers published in 1940–1955.)

British Kinematography, published by the British Kinematograph Society, 164 Shaftesbury Ave., London W.C.2, is an additional source of information in the English language. The activities of this organization, however, do not extend to Canada and United States to any appreciable degree.

The Canadian Standards Association sectional committee on Photography was organized in 1948. Three sectional committees are at work — Z 7.1 — Motion Picture Photography; Z 7.2 — Still Photography; Z 7.3 — Survey Photography. Committee Z. 7.1 has completed a review of all basic ASA and BSI motion-picture standards and to date 43 Canadian Standards in this category have been published. The committee meets at intervals to consider the status of existing and proposed standards. A subject at present under review is the losses in the area of a 35mm motion-picture frame in reduction to 16mm and reproduction in the television system.

Technical Committee 36 of the International Organization for Standardization has been set up to deal with motion-picture standards. At a meeting in Stockholm in June 1955, 40 delegates were present from Belgium, Czechoslovakia, France, Germany, Italy, Netherlands, Russia, Sweden, U.K. and U.S., and decisions were made on 14 proposals.

Many other organizations contribute to standardization of materials, equipment and procedures. In April 1956, the National Association of Television Film Directors in the U.S. published a preliminary report on a survey of all TV stations in the U.S. In reply to the question — the detail that gives the most trouble in film operations, 33% reported that this was: repairing films received in damaged condition, due to improper inspection.

The detail giving the least trouble in film room operations was not answered by 42% of stations; 91% had abandoned hand-punch cue marks on films. SMPTE leaders were used by 51% of the stations. Ideas and suggestions of problems needing discussion: 40% of the replies referred to a standard cue, 22% wanted better checking of film quality, and 8% asked for more information on how to clean film properly.

The motion-picture industry itself, particularly the 35 mm section of the industry, has established rigorous film handling practices and standards to maintain technical quality of theater films. Until television began to use 16mm film extensively, this film size was so-called substandard, reserved mainly for use in amateur and semiprofessional applications. The extensive use of 16mm film in nonpermanent projection sites, the operation of projection equipment by semiskilled personnel, the significance of cost of handling equipment, and the general attitude of the industry that 16mm film users and viewers were relatively noncritical led to a relaxation of rigid 35mm film standards in this field. Television suffers from these factors as well as the urgent time and quantity demands of the new medium.

It is not possible to make picture and sound images on 16mm film equal in quality to 35mm film, due mainly to the limitations of the smaller film size. However, there is sufficient evidence in television to indicate that in the present state of development, 16mm films can be made with acceptable quality for broadcasting purposes, providing extreme care is taken with the smaller size. To achieve a high standard of picture and sound quality with 16mm film, however, much greater attention is required than in handling 35mm film.

The first objective in the attainment of high quality is to produce scrupulously clean, scratch free, undamaged film. If the very large number of defects of this nature which now occur in 16mm television films could be eliminated or at least materially reduced this would represent a significant improvement, and attention could be directed towards other more obvious defects such as image steadiness and sound quality.

Errors of Interpretation and Clarity in Motion-Picture Standards

By E. K. CARVER

Although one of the rules in the writing of standards is that they should be so clear and definite that they are capable of only one interpretation, nevertheless there have been several cases in which our standards have been misinterpreted. In some cases the "fault" can be ascribed to the fact that the reader did not use perfect logic in interpreting them. The author believes that when standards are misinterpreted the fault is always with the writer of the standards. The remedy proposed is a discussion of purpose and use of the standards, and especially a discussion of tolerances and the reasons for setting them as they were set.

THE MOST important features of a good set of standards in any field are probably these:

1. The particular things to be standardized should be carefully chosen so as to accomplish a definite and useful purpose.

2. The values, dimensions, or statements that become the standards should be accurate and practical.

3. The meaning of the standards should be unambiguous and easily understood.

This paper is concerned almost entirely with paragraph 3.

Since much of our learning is by experience, let us examine some of the motion-picture standards that have been misunderstood in the past and attempt to draw lessons from these misunderstandings. It is my belief that whenever standards are misinterpreted by competent engineers, the fault lies with the writer of the standards. The customer, or the reader in this case, is never wrong.

The first grave misunderstanding started in 1932 when the first proposed standard for 16mm sound film was published. The American industry agreed upon the standards and incorporated them in the drawing shown in Fig. 1. This drawing contains a great deal of information. It shows that we had planned to give up the perforations on one side of the film and have the soundtrack in place of them. It shows the width of the soundtrack, the space between the soundtrack and the picture, the placement of the soundtrack, etc. The word "TITLE," if it is properly interpreted, indicates that the soundtrack would appear on the righthand side of the screen if the projector gate were cut away so that we could see it. Now in 35mm film, the soundtrack is on the opposite side.

The Germans were developing their own sound projectors, and, wishing to follow the American lead, they started building projectors and published a drawing in 1934 which was very similar to ours. Instead of using the word "title" to indicate which side the soundtrack was on, they wrote it out. But since the Americans were so sure that the Germans had copied their standard, they did not immediately pick up the error. It was only after considerable time and money had been wasted that the disagreement was discovered and an agreement was finally reached.

Now according to my idea, the first error was committed by the Americans. Technically, perhaps, they did not commit an error except from the point of view that they failed to emphasize the change they had made. Instead of calling attention to the change in position of the soundtrack and discussing the reasons for the change they merely indicated it as briefly and concisely as possible by the position of the word "TITLE." It took some accurate thinking on the part of the reader to correctly interpret the meaning of this word.

Another misunderstanding of our standards came to light when the French delegate at the ISO conference pointed out that the French were having trouble in following the American standard for the position of the sound relative to the picture. The American standard says: "The separation of the sound and the corresponding picture shall be 20 frames plus or minus one-half frame." In large theaters the French had found it desirable to put the sound 21 frames or 22 frames ahead of the picture so as to allow the sound and picture to appear synchronized at the midpoint of the audience.

They did not wish to print the sound 21 or 22 frames ahead of the picture because they felt they were violating an accepted standard. In order to synchronize the sound with the picture at a midpoint in the theater, they found that they had to thread the film with a shorter loop, say 18 or 19 frames, between the picture and the sound, and many of the projectors would not accept such a loop. They assumed, of course, that when our standard said 20 frames, it meant that all films should be printed with the sound 20 frames ahead of the picture. This apparently is not what our standards group meant. They meant that 20 frames would synchronize the sound at the screen and that if people wished to synchronize the sound 50 or 100 ft away, they would naturally print the sound 21 or 22 frames ahead. This question is now being clarified.

Another standard which has been misinterpreted was the old standard for Winding A and Winding B. The standard reads: "When a roll of 16mm raw stock perforated along one edge is held so that the outside end of the film leaves the roll at the top and toward the right, winding A shall have the perforations along the edge toward the observer, and winding B shall have the perforations along the edge away from the observer. In either case, if the film is wound on a pool with a square hole in one flange and a round hole in the other flange, the square hole shall be on the side away from the observer."

This seems perfectly clear. It was designed so that film can be printed first in one direction and then in the other without rewinding.

There was no trouble until the film was needed on spools with one round hole and one square hole. The designation for this is perfectly clear in the standard, but as will be seen from Fig. 2 it is obviously not what is wanted for this type of printing. A winding similar to "C" in this figure would be required but this winding is not included in the standard.

This standard was misinterpreted by the users simply because they knew what they thought it ought to say, and so they assumed that this was what it said.

All three of these misinterpretations could have been avoided if it had been the custom to write standards with footnotes, explaining the uses, the reasoning that led to them, and any particular difficulties that the standards were designed to avoid.

In the early days of our standardization, there were several unwritten rules that guided our practice:

1. There must be no redundancy.

2. Explanations were not needed. We were not writing a treatise on good practice.

3. The drawings and figures were of prime importance. The descriptions should be as short as possible.

Presented on April 29, 1957, at the Society's Convention at Washington, D.C., by E. K. Carver, Eastman Kodak Company, Kodak Park Works, Rochester 4, N. Y.
(This paper was received on April 20, 1957.)

Table I. From American Standard Dimensions for 35mm Motion-Picture Short-Pitch Negative Film, PH22.93-1953 (*Jour. SMPTE, 62:* 89, Jan. 1954).

Dimensions	Inches
A	1.377 ± 0.001
B	0.1866 ± 0.0005
C	0.1100 ± 0.0004
D	0.073 ± 0.0004
E	0.079 ± 0.002
G	Not > 0.001
*H	0.082
I	0.999 ± 0.002
†L	18.66 ± 0.015

* A calculated value for a dimension not measured routinely in production.
† This dimension represents the length of any 100 consecutive perforation intervals.

4. All dimensions should have tolerances.

As the years have passed and standards have been revised, we find that we have drifted away from some of these rules. Footnotes have been added and the meanings have become clearer. The standards are easier to use. I believe there will be fewer and fewer misunderstandings in the standards that are written in the future.

There is one part of the standards, however, in which no improvement has been made. I refer to the tolerances, to the values we assign to them, and to the method of expressing them.

Let us look at some of our tolerances. Table I shows the tolerances for 35mm film dimensions taken from ASA PH22.93- 1953. You will note that practically all of the values show certain dimensions with plus and minus tolerances. In Table II, however, we have a similar set of dimensions except that one particular dimension, A, the width of the film, is expressed as $1.378 \pm^{0.000}_{0.002}$. What was the purpose of this change if the values are the same; why express one in one way and the other in another way?

The reason is that the standards

Table II. From American Standard for 35mm Film — Cutting and Perforating Negative and Positive Raw Stock, Z22.1-1936 (*Jour. SMPE, 30:* 261, Mar. 1938).

Dimensions	Inches
A	1.378 + 0.000 − 0.002
B	0.1870 ± 0.0005
C**	0.1100 ± 0.0004
D**	0.0780 ± 0.0004
E	0.134 ± 0.002
F	1.109 ± 0.002
G	Not > 0.001
L*	18.700 ± 0.015
R**	0.020

* L = the length of any 100 consecutive perforation intervals.
** This single style of perforation, known as the SMPE perforation, shall be used for all 35mm. film. It is the same as the perforation known prior to July 14, 1933, as the standard positive perforation.

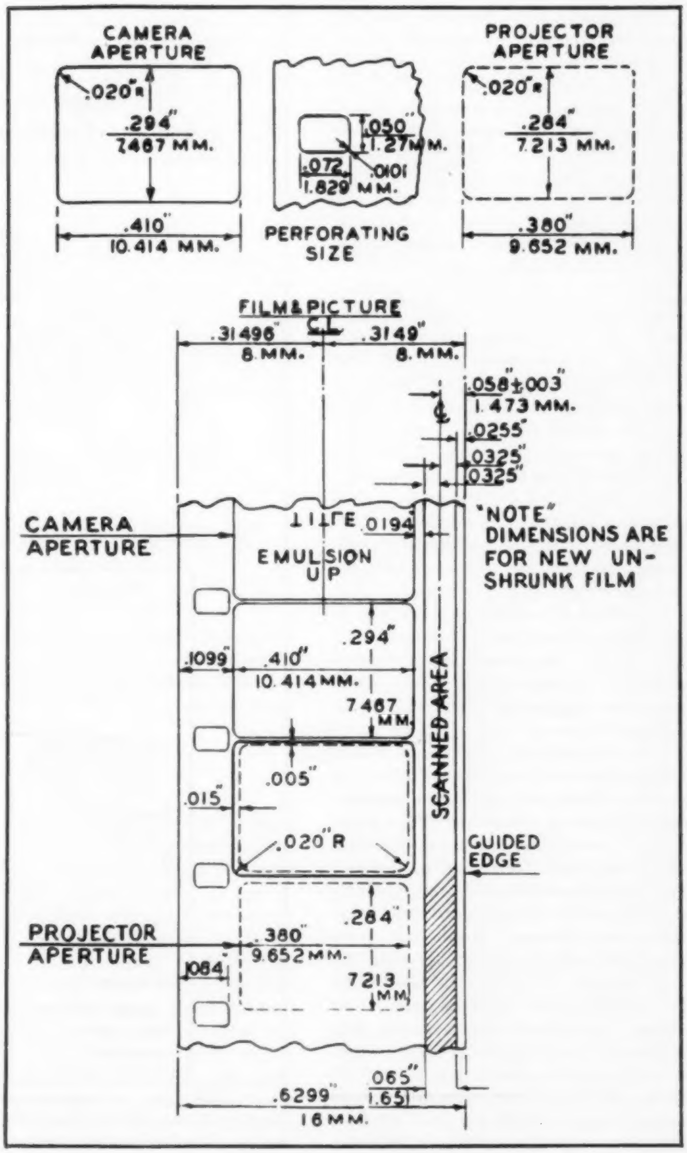


Fig. 1. Recommended standard, 16mm sound film (*Jour. SMPE, 19:* 478, Nov. 1932).

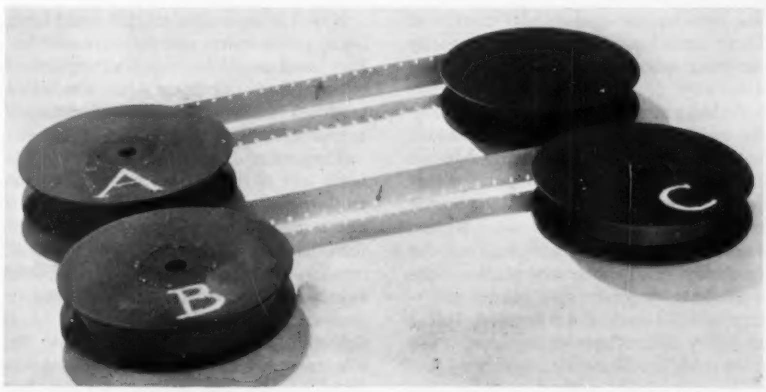


Figure 2

writers wanted to tell the reader that the upper limit was more important than the lower limit. They didn't want to come right out and say so in plain English because that did not seem to be the way standards are written.

They wished to say "the upper value is the one that must not be exceeded because if you exceed it, the film will probably stick in a gate or between flanges. You really ought to keep as far away from this value as you can."

However, there might be another interpretation that would be like this. "The upper limit is the important one. It is also the nominal value. Keep your dimensions as close to this as possible so as to avoid sloppiness and weave in some printer or sound recorder. Of course you hould not exceed this limit if you can help it, but keep as close to it as you can."

Now the point I wish to make is that there is no harm in using words to explain these things. If the standards writers have a meaning they wish to convey, let them say so directly and clearly.

Let us look at another standard: Fig. 3, the standard for 16mm reels. In this standard we have six ways of expressing tolerances. In most cases it is fairly clear what they mean, but there are some ambiguities.

You will note that dimensions A and B show plus zero and minus three-thousandths tolerance. R and S show maxima only; T shows a maximum and a minimum; U shows a symmetrical plus and minus tolerance; V shows minus zero and plus five-thousandths tolerance, while W at periphery shows an unsymmetrical plus and minus tolerance. Now these tolerances were not written in six different ways without a purpose. In some cases the purposes are perfectly clear, as where a maximum only is shown. But in the other cases it is not always so clear. Let us consider dimensions A and B. These are both dimensions for a hole through which a shaft is to go. Note that ordinarily it is the custom to give the hole a zero minus tolerance and a positive plus tolerance, indicating that the hole must under no circumstances be smaller than the shaft intended to go through it. But here we use a zero plus tolerance. There must have been some reason why the group who wrote this standard wrote it this way.

Perhaps we can throw some light on the question if we consider the standard for "Spindles for 16 Millimeter Motion Picture Projectors." Here it is stated that the diameter of the round section and the length of a side of the square section shall be 0.312 ± 0.003 inch. Thus the maximum shaft diameter and the minimum hole diameter will have a clearance of 0.001-inch. But it is still not clear why they did not specify the hole size as 0.316 $\pm^{0.003}_{0.000}$. It must have been because they really wished to state that 0.319 inch was actually a preferred size.

American Standard
for
16-Millimeter Motion Picture Projection Reels

ASA
Reg. U. S. Pat. Off.
PH22.11-1953
Revision of
Z22.11-1941
and
Z52.33-1945
*UDC 778.55

Page 1 of 4 pages

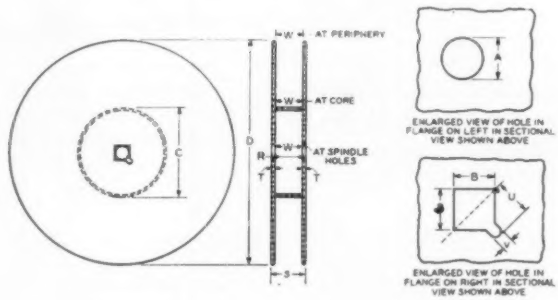


Table 1 See page 3 for notes.

Dimension	Inches	Millimeters
A	0.319 +0.000 −0.003	8.10 +0.00 −0.08
B	0.319 +0.000 −0.003	8.10 +0.00 −0.08
R[1]	0.790 maximum	20.06 maximum
S[2] (including flared, rolled, or beveled edges, if any)	0.962 maximum	24.43 maximum
T (adjacent to spindle)	0.027 minimum 0.066 maximum	0.69 minimum 1.68 maximum
U	0.312 ±0.016	7.92 ±0.41
V	0.125 +0.005 −0.000	3.18 +0.13 −0.00
W, at periphery[3]	0.660 +0.045 −0.025	16.76 +1.14 −0.64
at core[4]	0.660 ±0.010	16.76 ±0.25
at spindle holes	0.660 ±0.015	16.76 ±0.38
Flange and core concentricity[5]	±0.031	±0.79

Approved September 11, 1953, by the American Standards Association, Incorporated
Sponsor: Society of Motion Picture and Television Engineers
*Universal Decimal Classification

Fig. 3. First page of PH22.11-1953 (*Jour. SMPTE, 61:* 339, Sept. 1953).

They wished to have at least 0.004 inch clearance, but did not want much more.

Now I believe that all this could have been stated more clearly in footnotes. Footnotes would have the advantage of letting the reader know what was really intended rather than making it necessary to guess.

The case of dimension V (Fig. 3) is the same sort of dimension, namely, a hole or slot, and yet in this case it has a zero minus tolerance and a plus 0.005 positive tolerance. This seems to be perfectly regular. The slot is made to take a $\frac{1}{8}$-inch key but a 0.005 tolerance is allowed in the larger dimensions.

We have shown that in fixing the tolerances for the various standards, the standardizing groups really do feel that some tolerances are more important than others. We have shown that they should state these relative importances in clear words rather than by the manner in which the pluses and minuses are used. We are still faced with the problem as to what criteria we should use in setting the tolerance values. In some cases they are important and in some cases, unimportant.

Sometimes close tolerances are difficult to meet and sometimes not. Should the tolerances be set so as to meet some minimum of picture quality, letting the refinements be a matter of competition, or should the tolerances be set to give optimum picture quality, permitting manufacturers to meet them if they can? These are difficult questions. The answer lies somewhere between the above extremes, but the best compromise

will be reached in each case through a description of the needs for each tolerance and of the difficulties that will be encountered when tolerances are exceeded. Perhaps each standard will become a short treatise on its particular subject, but if it is a short one, and a clear one, it will contribute to the improvement of motion-picture production. In those cases in which the manufacturing tolerances are close to the quality tolerances the newer techniques of the quality control people can be used. Means and standard deviations can be specified.

I do not believe it is possible to sandardize on methods of standardization, as for example, when to use symmetrical tolerances and when not to use them. However, I do believe that there is a golden rule which says: "Write standards and tolerances for other people to use as you would like other people to write them for you."

Discussion

Deane R. White (E. I. du Pont de Nemours & Co.): There is a point that you did not mention with regard to one of your unsymmetrical vs. symmetrical tolerances that has come up and caused trouble at the international level. You had, in millimeters, 35.00 plus 0 minus 05. In the other case of the symmetrical tolerances you had 34.98 plus or minus 03. In this problem not only do we have this question that Dr. Carver has been speaking of — the "clear understanding," but when we come to express the tolerances, both in inches and in the metric system, we get into additional troubles in expressing tolerances. In the international standards currently under discussion that is one of the greatest problems that we face. When you express the tolerances in the two systems, you may not be specifying the same thing unless you are very careful. You may have to go to a tolerance specification with more significant figures than is desired by workers in either the English or the metric system.

James A. Moses (Session Vice-Chairman): I'm sure all of us who have worked in the various committees recognize the importance of the precautions and statements that Dr. Carver has made and I know of no other person who could give us better guide rules to help us determine how to make these tolerances.

Test Films — Standards at Work

By BOYCE NEMEC

Uniqueness of content sets one motion picture apart from any other. Yet to reach its audience at all, that same motion picture must be precisely standardized, a rigorous condition not imposed upon any other creative product. One of SMPTE's jobs is to determine "how standard." How this is done through test films is explained in this paper.

PUBLISHED transactions of one of the earliest meetings of the Society report on what seems in retrospect a very primitive problem in standardization — or more properly, the lack of it.

Camera work for a Department of Agriculture film had been assigned to two crews who were to work simultaneously in different parts of the United States, with films to be sent to Washington where the picture was to be edited. We must assume that each crew did its work properly and that footage sent in was acceptable because both were kept on the job until their individual assignments had been accomplished. All went well until the editor began roughing out the finished picture. The record is not clear, but either he or a projectionist learned about standards of interchangeability the hard way, for it was discovered that one of the cameras had placed the frameline on the centerline of a lateral pair of sprocket holes while the other had placed the frameline halfway between. The film could not be intercut.

Certain standards of interchangeability needed at that time did not exist. It was such needs as this that helped move a group of experimenters and practitioners in the then nearly 30-year-old "industry" to organize this Society in 1916 and to hold it together during its early shaky years.

Standardization was and is one of the Society's principal official functions. It moved ahead solidly if slowly. By 1922, film dimensions, and image size and location had been formally tied down. In the mid-twenties, the coming of sound introduced a new order of precision and imposed some new and rigorous standardization and interchangeability problems on engineers.

About the same time the American Standards Association entered the picture, bringing the benefits of national standardization experience plus the national and international values that attach to ASA accreditation.

The motion-picture industry was growing both at home and abroad. It had demonstrated a need and a desire for engineering standards, particularly those involving interchangeability, to insure the ready exchange of motion-picture films.

To meet this need the members of the Society of Motion Picture Engineers and later the active participants in the work of the Motion Picture Research Council contributed the practical experience and professional knowledge essential to technical accuracy and editorial competence in the drafting of standards content. The Society's Board of Governors and the committees on procedure of the American Standards Association became formal safeguard agencies insuring that all interested individuals were given equal opportunity to express their views on any standards proposal; the *Transactions* and *Journal* of the Society became the recognized medium for making standardization efforts and accomplishments known to a specialized worldwide audience.

Thus the essential elements in the process of standardization came into existence. A review of the history of some of the basic standards in use today will show that these elements functioned effectively.

A standard has been defined by Ralstone R. Irvine, an authority on the legal aspects of standardization, as "...simply a definition of a product or procedure in terms of certain features." And he continues: "Standardization, accordingly, is simply the process of reaching agreement on the form and content of such a definition."

Within these boundaries there is a continuing need for precision and uniformity in all dimensional references and tolerances. A need exists also for care and precision in the development of the supporting language.

Thus, we have defined a standard and have stated that (1) it must be technically accurate; (2) it must be as understandable as words will allow; (3) it must be the product of joint effort; (4) it must represent the views of all interested parties; and (5) channels must be available for making its presence known.

Test films, apparently, are standards which meet all of these conditions and have two additional virtues worth noting: they are self-contained test devices that, in effect, apply themselves and so are little subject to errors of

Presented on April 29, 1957, at the Society's Convention at Washington, D.C., by Boyce Nemec, Management Consultant, 141 E. 44 St., New York 17.
(This paper was received on April 15, 1957.)

individual interpretation; and they perform their measurement functions at the point of end use.

In a class by themselves, they are truly standards that work. They are standard gauges. So the standards program is a fundamental gauging program.

There are 16mm and 35mm test films; picture-test and sound-test films; films that carry conventional picture and conventional sound and depend for reliable application upon the use of a good eye and a good ear; sound films for completely quantitative testing whose capacity to generate a signal means nothing to the ear but requires an appropriate piece of conventional test equipment for evaluation. There are sound test films, all copies of which are original recordings direct from a calibrated signal source and others that are printed from a negative. Some films are intended for use by equipment designers and development engineers while others are regular day-to-day test tools used in routine maintenance operations in studios, schools, repair shops and in theaters and television stations.

Each of the 39 films and test slides now available from the Society was designed to serve a particular purpose.

A series of 16mm technical test films covered by American Standards was the product of special attention given during World War II to the Army's need for 16mm sound projectors of higher initial quality and of more reliable long-term performance than had been available from commercial sources. These films are now the standards of the industry, used by the military in acceptance testing of new and repaired equipment, used routinely in television stations as maintenance tools and used by projector manufacturers for quality control and demonstration.

In the area of 16mm visual tests is a new and remarkable black-and-white film described recently in the *Journal.* This film is finding wide use in the aligning and testing of 16mm optical printers as well as in testing for travel ghost and for quantitative determination of projector steadiness, effective aperture size and dynamic resolution of the overall projection system.

Magnetic recording has now become widely adopted not only for original recording in the studio and for 16mm and 35mm re-recording, but also for some 16mm, 35mm and wide-film release. Initially there was no absolute signal level standard and it was necessary for each magnetic system user to establish his own. Then when a Navy research project produced an original recording of known recorded signal level, the first in a series, the Society acquired one of the absolute standards and is now offering to all who are interested, secondary standards calibrated against this one.

The Society publishes a *Test Film Catalog* which contains titles and standard number as well as some quantitative information and the complete story on the standards with which they comply.

The work that has gone into the test film programs of the Motion Picture Research Council and of the Society has not even begun to be measured, but it is certain that in total it would be an impressive figure.

The two organizations that have conducted these programs have organized their work effectively and have seen it through in every instance to a clean-cut and useful conclusion. This is a good record. But it is a continuing job, one that needs close attention.

It would seem that the Society needs not only prompt attention to new test film problems as they arise, but also a new program aimed at encouraging the more effective use of the test films now available. These are working standards that should be within arm's reach of every projection room work bench, every repair shop test stand and every 16mm and 35mm television projector.

Every entertainment film, every educational film and every television program film was made with a purpose in mind but that purpose will not be realized unless the projection and sound equipment used are up to standard in their performance.

Discussion

Glenn Dimmick (*Session Chairman*): What is the trend in the use of test films. What has been happening in the last few years?

Mr. Nemec: Up until a year ago, at least, the total distribution of test films was pretty consistent; but, the fact that it was consistent turned out to be a danger sign. Volume remained almost uniform through the period of the introduction of CinemaScope and the installation of a good many CinemaScope equipments in theaters. The Society distributed CinemaScope test films in substantial volume but the quantity of other films fell off. I'm sure that this was not the direct result of decreasing need for other test films but was perhaps a result of the Society's devoting an excessive amount of attention to some of the problems that CinemaScope brought, combined with a decreasing amount of attention to some of the 16mm users and their film problems.

William E. Youngs (*U.S. Information Agency*): What is the Society doing to encourage the use of a standard release print? I've been a member of Local 224 for quite some time and it's been a long time since I've seen a standard print. We see brand new prints coming out with the leaders all mixed up. You can't even rely on the accuracy of the footage numbers. You see extended leaders; the 9-foot start mark may be 12 feet from the beginning of the film. Although that is an exception, it is indicative. You actually have to measure each one in order to get your correct starting point.

Mr. Nemec: That is one of the problems inherent in standardization. Within SMPTE and ASA the machinery exists for preparing standards. The people who work on standards are competent engineers. They are interested, and so make themselves available to do the technical work involved; their standards are publicizable and they are pretty well publicized; but it's basic that there is not, and should not be, any machinery in ASA or in the Society for policing the use of those standards, because they're completely voluntary.

Certain trade associations are in a slightly different position and, in order to improve the lot of their consumer customers and of their members, they sometimes adopt a bit of a promotion campaign with the general public. They cannot force the use of standards; but they're in a fairly strong position because they're more concerned with the dollar and cents aspects of standardization, where we try to stay just one arm's length away from that aspect of it.

Other than publication there isn't much the Society can do. The Research Council is doing a great deal now in the way of missionary work with theaters. They have two engineers, I believe, who are calling on theaters, talking to projectionists, asking them what their problems are; they're coming back with perhaps the same kind of answers, or the same kind of questions, the same kinds of problems that you just expressed. Perhaps they will eventually solve your problems.

Department of Defense Photographic Standardization Plans

By PHILIP M. COWETT

The 82nd Congress enacted Public Law 436, known as the "Defense Cataloging and Standardization Act," which enjoins the Armed Forces to standardize to the maximum extent practicable. Public Law 1028 of the 84th Congress reaffirmed the intent of the previous Act. This paper discusses the steps being taken by the Department of Defense to carry out the provisions of the Act. Examples in the projection-equipment field are presented.

The Department of Defense Photographic Standardization Plans discussed in this paper include:

1. The assignment of standardization responsibility to individual military departments by Federal Supply Classes.

2. The establishment, publication, review and revision within the Department of Defense of military specifications, standards and lists of qualified products, and the resolution of differences between the military departments, bureaus and services with respect to them.

3. The maintenance of liaison with industry advisory groups to coordinate the development of military standards and specifications with the best practices of industry.

4. The standardization of items used throughout the Department of Defense by developing and using single specifications, eliminating overlapping and duplicate specifications and reducing the number of sizes and kinds of items that are generally similar.

5. The standardization of methods of packing, packaging and preserving standardized items.

6. Making efficient use of the services and facilities for inspecting, testing and accepting those items.

Authority

These plans are authorized by the Defense Cataloging and Standardization Act (Public Law 436, 82nd Congress). This Law, which was reaffirmed and expanded by Public Law 1028 of the 84th Congress, provides for the establishment of a supply standardization program under the Defense Supply Management Agency. The Act enjoins use of single specifications, elimination of overlapping and duplicating item specifications and reduction of sizes, kinds and types of generally similar items. It also provides for a single Department of Defense catalog system.

Presented on April 29, 1957, at the Society's Convention at Washington, D.C., by Philip M. Cowett, Dept. of the Navy, Bureau of Ships, Code 565E, Washington 25, D.C.
(This paper was received on April 26, 1957.)

The Department of Defense Reorganization Plan No. 6 of 1953 reassigned the responsibilities of the Defense Supply Management Agency to the Secretary of Defense and a Department of Defense Directive (5126.1, August 13, 1953) delegated the responsibilities to the Assistant Secretary of Defense (Supply and Logistics).

Department of Defense Directive 4120.3, October 15, 1954, restated and clarified the objectives of the program and the methods of achieving the objectives. It requires the development of detailed plans for the accomplishment and maintenance of standardization by assigned departments in cooperation with other interested departments. The standardization assignment by FSC (Federal Supply Classification) classes includes responsibility for standardization of items, methods, codes, nomenclature, marking, packaging and preservation of items within the class.

Standardization Policies

The basic standardization policies of the Department of Defense are as follows:

1. There shall be but one Department of Defense standardization program.

2. It shall be an accelerated program.

3. The office of the Secretary of Defense shall manage and control the program by planning, directing and reviewing its operation which, in turn, shall be decentralized to the military departments with authority to further reassign portions of the operation as necessary.

4. Interdepartmental coordination on all standardization matters having an impact on more than one department shall be required.

5. Assignments and sub-assignments to the military departments shall be made on the basis of departmental capacity and supply interest.

6. The coordinated specifications and standards derived from standardization effort shall be mandatory for use throughout the military supply systems and in the design of new products where practicable. Any deviations or waivers from specifications or standards shall be approved by competent authority and justified in writing.

7. The standardization efforts shall not be limited to domestic standardization only.

8. Industrial coordination shall be required in the development of standards.

9. Industrial standards shall be adopted where practicable for military use.

Basic Objective

The basic objective of the Defense Standardization Program is to improve, simplify and make economical the performance of logistics functions. This objective also includes promotion, through design practices, of the utmost practicable uniformity and interchangeability of items required to fulfill departmental missions by limiting the selection of material, parts and procedures. All action designed to reduce varieties and kinds — whether of physical objects or of engineering and technical processes — are of concern to the Standardization Program. Standardization is not an end in itself but is a means to improve supply management, and should never operate to the detriment of research and development or the realization of operational requirements.

Engineering Standardization

Engineering standardization is an integral part of the total standardization program. It has brought about the following concepts:

1. Dimensional and functional interchangeability.

2. Uniformity of communications, that is, common recognition and exchange through standardized drafting room practices, symbols abbreviation, codes, etc.

3. The development of basic characteristics of equipments, items and materials.

4. The standardization of engineering and production processes, procedures and practices, etc.

Application

In applying the standardization program, each photographic item presently in stock or about to be procured must be examined by Joint Committees appointed according to the provisions of Department of Defense Directives. The committees must consider four main questions in examining the items: Is there overlapping in types and functions? Can the number of types be reduced? Are all

the features built in as part of the equipment in question required? Can the services actually get together on one common item?

A job of this nature requires a great deal of research and frequent meetings of the committees.

Detailed Plan

The initial step taken by the service assigned to the task of coordinating the standardization of a given group of items in the appropriate FSC class is to develop a detailed plan for the approval of the Department of Defense. The plan must outline each step to be taken toward the standardization of the specified items and must include a list of industrial firms with which coordination is appropriate. If it is considered desirable, joint public advisory committees may be established to assist in standardization.

Members of the working groups who determine the extent to which standardization of individual items is feasible are expected to have a knowledge of engineering and also specialized knowledge of the items under consideration.

Item Studies

The photographic items under the jurisdiction of the assigned working groups are examined to determine which equipment features are acceptable and can effectively be utilized by the military departments. Features which are questionable or are considered too costly for the services they perform are dispensed with.

In the standardization of an item, such as a 16mm sound motion-picture projector, it is necessary that many piece parts be given close scrutiny. While the equipment as presently used by the military departments may be somewhat similar, there may be individual preferences in switches, power plugs, transformer treatments, types of finishes, name-plate materials, etc. The "standard" equipment must be equally acceptable to all services and yet not contain unnecessary design variations.

Specifications

Based on committee discussions and investigations, specifications describing the items under consideration must be rewritten to describe correctly the performance and selective design requirements of the new standards. Prior to approval of the Detailed Plan these specifications are generally rewritten as the result of project assignments by the Office of the Assistant Secretary of Defense for Supply and Logistics. In the same manner, associated sheet standards are also prepared which select the equipment types which may henceforth be purchased for use by the military departments.

Specification and standard preparation time schedules, which are set, are dependent upon the urgency of equipment requirements and upon the availability of qualified personnel at the department designated preparing custodian. During preparation, the custodian must keep in close contact with other military coordinating custodians as well as with appropriate Government testing laboratories and with manufacturers, who produce equipment of the type covered by the specifications. These contacts may be in the nature of letters, telephone conversations or conferences.

The draft specification as initially prepared is intended to cover all the requirements of interested military activities. The comments of interested civilian agencies of the Government are also considered. The draft specification is circulated to military contact points, other interested Government agencies, and to industry for their comments.

Military Comments

Comments received from the contact points reflect the coordinated views of each military or civilian department. These are in the nature of "essential" or of "suggested" comments. All essential requirements must be made a part of a revised specification if at all possible. The suggested comments are those which may further improve the specification. The inclusion of these comments is left to the discretion of the preparing custodian.

Industry Comments

Comments received from industry may be more difficult to cope with since each manufacturer must, of necessity, bear in mind that he is in business to make a profit.

In some instances comments may tend to reflect the product which the manufacturer is producing. However, in general, comments received from industry are excellent. We know that most manufacturers have an honest desire to assist the military whenever possible.

There is also a willingness on the part of manufacturers to arbitrate their comments in order to assure the services of a specification which is satisfactory to all interested parties. When there are many industry comments, which cannot be easily reconciled, the specification custodian may either try to arrive at a satisfactory solution himself or he may arrange a roundtable conference with the manufacturers to discuss the various comments in an effort to reach a solution which will be satisfactory to all. Those comments which have the support of the majority of manufacturers are adopted if at all possible. Those comments which are acceptable only to a small minority of manufacturers and contrary to the majority opinion are not adopted unless the services have a very good reason for accepting them. In these instances, the services present their viewpoint in an effort to obtain industry agreement. After such discussions, the specification is ready to be rewritten unless, of course, some of the methods of test have been under attack. In this case, it may be necessary to work out completely new methods for conducting certain tests. This could require the services of a testing laboratory, which is thoroughly familiar with the various methods of test, and which has the facilities to conduct the tests.

Fig. 1 The JAN Projector.

Example

The JAN 16mm projector is an example of some of the standardization accomplishments of the Department of Defense. This projector resulted from a specification initially prepared by a committee composed largely of members of this Society. This specification, JAN-P-49, was prepared as a production specification. It was rewritten as a developmental specification since it was not then possible to meet many of the production-type requirements. This resulted in developmental contracts by both the Signal Corps and the Bureau of Ships and very close cooperation be-

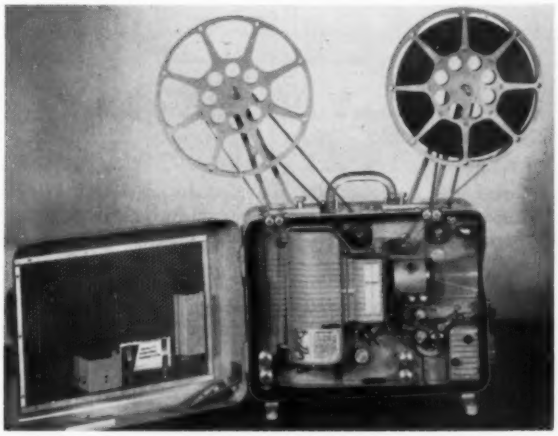


Fig. 2. Single-case unit of the JAN Projector.

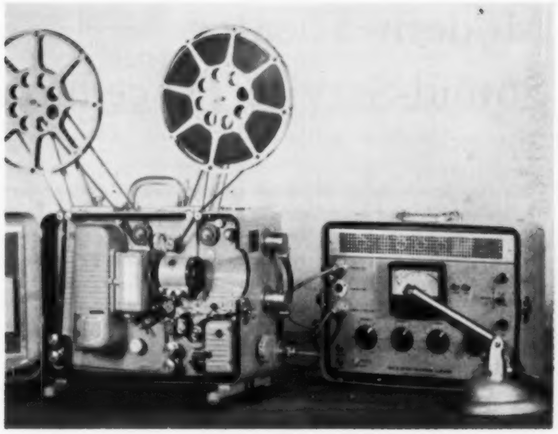


Fig. 3. Single-case unit of JAN Projector, with record facility.

tween the two services regarding military characteristics, performance and general design requirements. In 1946 it was not mandatory that the services join hands to produce a standard projector; however, it was realized that by working together a much better product conforming with the requirements of both services could be obtained. This cooperation resulted in the JAN Projector (Fig. 1.). Both services were responsible for many of the features, which are a part of this design. Changes in the design of this projector were brought about through suggestions from various field activities, by changes and improvements in the art, and by changes in military requirements. This three-case projector (loudspeaker not shown) was used in shipboard motion-picture booths and by various continental U.S. and overseas shore stations. It conforms with SMPTE recommended performance characteristics.

Based upon the requirements of training personnel for a stripped-down version of the three-case projector, the single-case unit shown in Fig. 2 was evolved. Here again close cooperation among the services resulted in nearly identical projectors for each department. Comments received from both ships and shore stations indicate that this single case unit is an important addition to the three-case predecessor. This unit is not equipped for dual operation as it has no changeover facilities. It can, however, be easily modified in the field to include the changeover facilities of the three-case unit. It further can easily be modified in the field to reproduce sound from magnetic track on film. The "record" feature can also be incorporated if desired. This equipment is shown in Fig. 3.

In carrying out this program, the Department of Defense must rely, to a large extent, on equipment manufacturers and technical societies. In the standardization of photographic goods the Department relies heavily on the accomplishments and decisions of the technical committees of the SMPTE.

Detailed Standardization

It is difficult to comprehend the tremendous scope of the Defense Standardization program. Each nut, bolt, washer, switch, lamp and sprocket, and all characteristics, finishes, tests, etc., in each piece of equipment used by the Department of Defense must be closely examined and decisions made as to the modifications or eliminations necessary to achieve complete interchangeability.

For example, at a recent meeting in New York, all 16mm splicers listed in the supply catalogues of each department were compared. Also, preliminary standardization of hand rewinds was accomplished. One geared-end and one brake-end rewind were selected. Hand rewind sets as such were eliminated. In the future, supply depots will order only the approved items. Instead of receiving a huge package containing a geared-end and a brake-end mounted on a board, the depot can mount the rewinds on a board, workbench, film inspection machine or any other place desired. This may seem a small item but it will result in long-range savings to taxpayers and certainly will not be injurious to manufacturers.

The Defense Department policy of using commercial equipment when it is possible to do so is well known. If commercial equipment is unsuitable or unavailable, the services may design the equipment through a military specification which permits all manufacturers of similar equipment to offer competitive bids.

Discussion

Boyce Nemec (Management Consultant, New York): Was this new standardization program adopted as a big head-on, across the board, re-standardization program for all photography? Or was it set up with an order of priority?

Mr. Cowett: I should like to call on Mr. Hutchinson of the Office of the Assistant Secretary of Defense to answer that, if I may.

W. S. Hutchinson: We are going to review, in some detail, all the commodities which we purchase and stock in the military departments. As Mr. Cowett mentioned, we have assigned a department the responsibility for certain Federal Supply Classes. In the photographic field, the Bureau of Ships has projection equipment; the Air Force has certain other types; Signal Corps, others; etc. Progressively, under the detailed plan which they develop in a cooperative manner, they will assign schedules for reviews by priority, as you suggest, on the major items of these equipments, the equipments which they stock, which they buy repetitively. They will assess, for each type of equipment, let's say it's a projector, or printer or dryer or cameras, etc., the types that we need, according to the requirements of the three services; and, within the types that are selected, the best features which we feel that are necessary for their performance. We will take, by priority, those items which have the greatest population, the greatest turnover, the greatest maintenance problems, first, and, progressively, go down through our entire system until we have reviewed everything that shows potential; we will not waste time on items that have no potential.

Ellis W. D'Arcy (D'Arcy Magnetic Products, Inc.): This then is a formal statement of Defense Dept. policy?

Mr. Hutchinson: I'd say, to the best of my knowledge, you may take it as a positive statement of D.O.D. policy.

Modern Theater Sound-Service Procedures

By EDWARD STANKO

With the development of better theater sound and projection equipment, the professional theater sound-service engineer must keep pace with the technical and engineering developments by constantly improving and, when necessary, revising service procedures. The requirements of such procedures, methods and the equipment used and their overall results are described

One of the most important items in the motion-picture theater business is providing the patrons with realistic sound. At first glance it would appear that this can be attained rather easily; but the problem of maintaining good, pleasing sound in all theaters, on a national scale, becomes quite complex. Since each theater has its own peculiar acoustical characteristics and sound-system features, it is not a simple matter to reproduce sound recorded by various studios under diverse standards and conditions. It is necessary, therefore, to coordinate all the procedures and processes from the initial sound recording on location, or in the studio, to the final reproduction in the theater to insure the utmost in quality.

While the general public is aware of and appreciates good sound reproduction, especially since many people have become more conscious of high-fidelity sound reproduction, very few people outside of the motion-picture industry know that to obtain good sound, and to keep it that way, requires the services of a competent service organization.

RCA has maintained for over twenty-five years, and still maintains, a service organization of over 200 sound-service engineers in the United States for regular and emergency theater sound service. These engineers are on call around the clock every day of the year to handle emergency situations regardless of the cause and without limit to the scope of the service. Improved service methods and additional service features are constantly being studied and adopted wherever the results of such studies prove that sound reproduction in theaters will be enhanced.

Training of Theater Sound-Service Engineers

Each theater sound-service engineer is given a comprehensive technical examination to determine his qualifications when he is employed. Many of the field engineers are college graduates; others have qualified themselves by working on projection and sound-reproducing equipment while acquiring a technical background through associated academic pursuits. As a trainee, a new engineer is given formal instruction at either the Home Office or Area Office level and on-the-job training in the field by a supervisor.

Since the advent of sound motion pictures, some thirty years ago, the motion-picture industry has gone through considerable technological change. All of these procedures and the associated information involved had to be collected and collated for distribution to field-service personnel.

Training and technical information are furnished on all types of sound-equipment systems so that the engineer can service practically any make of sound equipment. Refresher courses are frequently given to bring the field engineers up to date on new methods or procedures, and outdated methods of servicing are superseded by more modern servicing methods.

At the present time service is being given on the following types of theater sound-reproducing equipment:

Ampex	Simplex
Ballantyne	Synchrofilm
Century	Todd-AO
DeVry	Western Electric
Motiograph	Westrex
RCA	

Closed-Circuit Large-Screen Television

Coincidental with the servicing of theater sound-reproducing equipment, these engineers have been trained to install, service and maintain large-screen TV projection equipment. At the present time the following types of large-screen projection television equipment are being serviced: Fleetwood, General Precision Laboratory, RCA and Trad. In the pursuit of such activities, responsibilities have been contracted for the technical projector operations throughout the United States with Sheraton Hotel Chain, TelePrompter, and Theatre Network Television.

The above producers have developed and telecast programs for more than a score of national organizations and corporations.

On a national basis during 1956, projection operations were supervised for 43 closed-circuit telecasts, covering 565 locations. The highest number of locations for one telecast was 79, while the average number of locations per telecast was slightly over 13. The successful coordination between the pickup facilities, transmission media and projection equipment is evidenced by the fact that during all of the telecasts in 1956 no complete show was lost and sporadic interruptions were of only a minor nature.

Car Fleet

It has been estimated that RCA theater sound-service engineers travel more than 3,500,000 miles per year on scheduled service calls and on emergency calls. To make certain that regular calls are made on schedule and emergency calls answered immediately, a fleet of over 200 Company-owned automobiles is maintained. In the theater business, where minutes count, this fleet of automobiles is kept in first-class condition for service without delay.

Technical Data

All RCA District and Field Offices, and field engineers, are supplied with the latest technical and engineering information on the installation, service and maintenance of theater sound equipment. This data includes general recommendations made by the Motion Picture Academy Research Council as well as optimum reverberation frequency characteristics for sound motion-picture theaters, minimum theater power requirements and frequency-response requirements. Additional technical information is also on file at each District Office and Home Office to support the field engineers with such special information as may be required.

Test Films and Test Equipment

Each field engineer is furnished with calibrated test films for making frequency response checks and gain and power-output measurements on both optical and magnetic-track reproducing systems. Also supplied are test films for making film placement, optical alignment and magnetic reproducer tests.

Each engineer carries the following test films:

Presented on May 2, 1957, at the Society's Convention at Washington, D.C., by Edward Stanko, RCA Service Co., Inc., Engineering Section, Technical Products Service Div., Camden 8, N.J.
(This paper was received on April 5, 1957.)

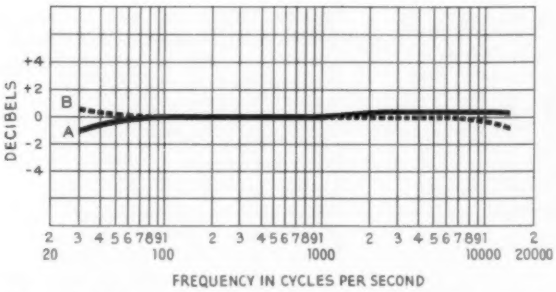


Fig. 1. Relative response measurements of A, the transistor amplifier alone; and B, the Weston 695 meter alone.

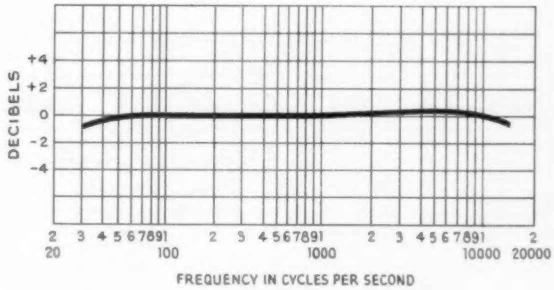


Fig. 2. Response of combined amplifier and meter.

*Optical ABZT 35mm buzz track;

*Optical A7KC 7000 cps;

*Optical ABLN 1000 cps balancing;

Optical RCA Special 300-cycle balancing;

RCA Special 1000 cps and −78 db gain check;

RCA Special short-run test film consisting of the following frequencies:

1000	125	3000	7000
70	400	5000	1000

*ASTR 35mm optical film (contains speech, music, etc.); and

RCA Special 45445-5 special frequency-response film.

and for Magnetic Sound:

*SL-1 35mm 1000 cps, 4-track;

AZ-1 35mm 8000 cps, 4-track;

*CH-1 12,000/1000 cps, 4-channel;

*MF-1 multifrequency test reel, 4-channel;

Additional special-purpose test films are also available when required.

Except for those identified as RCA films, all (*) in the above are Motion Picture Research Council or SMPTE Test Films described briefly in the Test Film Catalogs and more completely in instruction booklets which accompany the films.

Degaussing equipment is carried as part of the field engineer's equipment to demagnetize any machine parts that might possibly affect the magnetic sound-track. Modern decibel and voltage meters as well as tube testing equipment are carried in the field engineer's kit. An emergency or standby amplifier is also provided each field engineer so that sound can be maintained even when the main amplifier system fails.

Transitorized Weston Model 695 Output Meter. The modified Weston Model 695 Output Meter consists of a sensitive meter movement and rectifier preceded by a "T" pad attenuator network which is divided into attenuation steps of 4 db. The meter switch positions range from −4 db to +46 db. The standard meter scale, which is calibrated for a reference level of 6 mw in a 500-ohm load, is retained. This is very suitable for our standard theater service routines. For TV service work, conversions to 0 dbm level and 60-ohm load are available on a separate chart. The meter has constant 20,000-ohm input impedance.

Since a change of 8 db corresponds to a voltage ratio of 2.5, and a 12-db change corresponds to a voltage ratio of 4, the conventional multiple voltage ranges, with which the meter was originally equipped, remain unchanged. A series blocking capacitor is also provided for measurements where d-c voltages are present. Since the output of the "T" pad attenuator network was approximately 10,000 ohms (the impedance of rectifier and meter movement), the transistor amplifier input-output impedances approximate this value.

Several test amplifiers were constructed using various junction-type transistors. It was found that better than 35-db gain could be obtained from a two-stage amplifier, providing proper terminal impedances are observed. RCA 2N79 (junction p-n-p) transistors were finally selected because of their high quality, uniformity and hermetic seal.

Two-Stage Amplifier. The first stage of the two-stage amplifier finally adopted is a grounded collector type of circuit which is somewhat analogous to a conventional cathode follower. This stage has a high-input and low-output impedance characteristic. The second stage, a grounded emitter circuit which is somewhat analogous to a grounded-cathode vacuum tube stage, has a low-input and high-output impedance. The phase of the signal is not reversed in the first stage, but is reversed 180° in the second stage. This 180° phase relationship between the input and output circuits minimizes the possibility of signal regeneration. Phase reversal also eliminated the need for shielded wires and critical lead dress. Switching problems were simplified since practically any small switch could be used to introduce the amplifier into the meter circuit without involving capacity problems.

Convenient Switching Provided. A switching arrangement, involving a standard miniature double-pole, double-throw toggle switch, was devised to accomplish all the necessary switching. In the normal position the attenuator output is directly across the meter terminals and both the input and output of the amplifier are shorted. The battery is also disconnected from the amplifier circuit. When the switch is in the use, or transistor, position, the attenuator output is connected directly to the amplifier input, and the amplifier output is connected to the meter terminals. The battery is also connected in this position, providing power for the amplifier. In either position, the test probes remain in the same jacks on the meter panel.

Long-Life Battery. An RCA transistor battery, Type VS088, was selected and "pruned' to 12.6 v. This battery is designed for applications using continuous drains up to 10 ma. Since the total current drain for the amplifier is 0.6 ma, which represents a power consumption of less than 8 mw, long battery life is assured. Miniature tantalum capacitors are used as coupling capacitors since they provide large values of capacity in small physical sizes.

Response Measurements. One of the major uses for power-level meters of this type is for frequency-response measurements of audio-amplifying systems. It was, therefore, essential that the response characteristics of the amplifier be comparable to those of the original meter. Figure 1 represents the relative response of A, the amplifier alone, and B, the meter alone. Figure 2 represents the response of the combination. Although at extreme low frequencies the amplifier response falls off, the combination curve may be used to correct any overall measurements made by the instrument. Figure 3 shows schematically the modified transistor output meter.

Uses for the Meter. A modified output meter of this type has been used successfully for frequency-response meas-

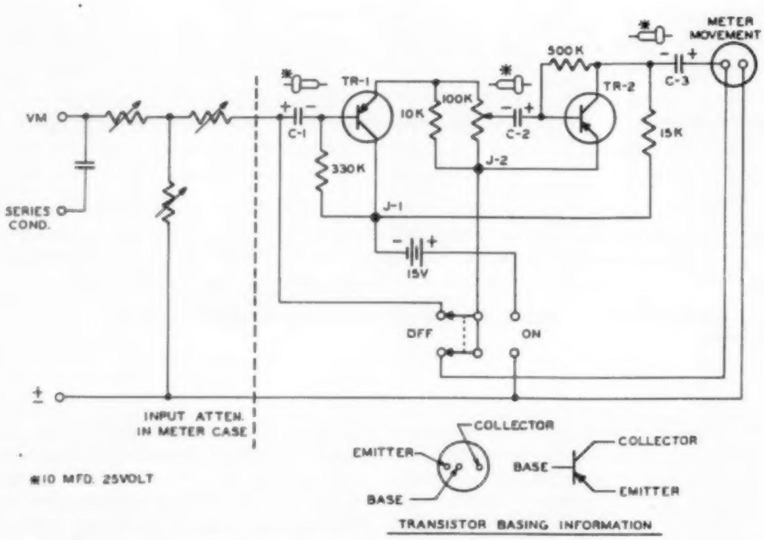


Fig. 3. Schematic of the modified transistor output meter.

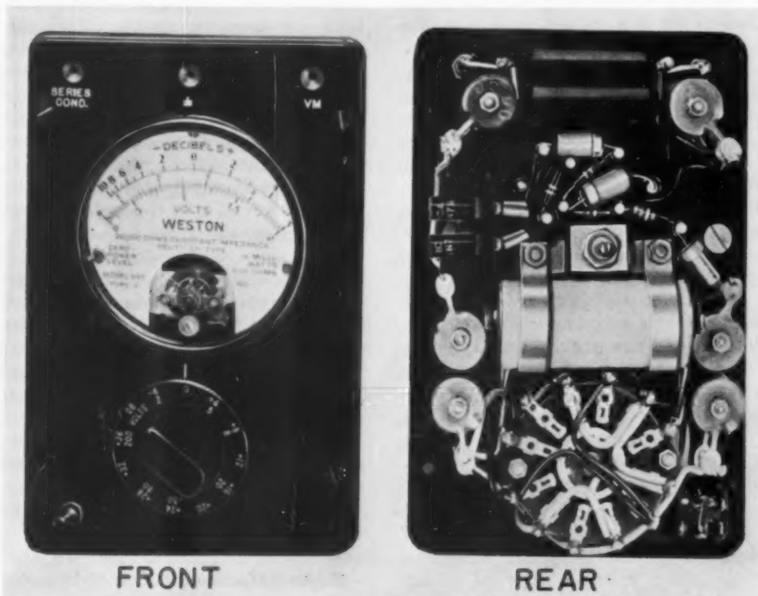


Fig. 4. The completed meter, after modification.

urements in theater and TV film projector sound systems. It has also been useful in the exploration of stray 60-cycle fields in connection with various types of apparatus maintained by the RCA Service Company. This type of measurement is accomplished by attaching a small probe coil to the input terminals of the meter. Fields which induce voltages in the order of a few millivolts can be easily detected. Although the modification described was designed primarily for the Weston Model 695 Output Meter, it is equally useful for extending the range of any similar a-c instrument. Figure 4 shows the completed meter.

Planned Theater Sound Service

Experience in providing theater sound service to thousands of theaters has shown that delivering efficient sound at the lowest cost to the exhibitor requires careful planning of all service organization activities. Most important of all is the conservation of time. Today, time is the most expensive item in any budget whether you are waiting for a haircut or a train, or rendering a theater service call. The rendering of a planned service call is the consummation of many phases of a service organization's activity which includes administration, operation, sales and engineering.

Because time is such an important factor in this business, we have developed a service procedure for the service engineer with the following objectives:

A completely planned service call;
More efficient service;
Better coverage;
Lowest cost to exhibitor;
Better customer satisfaction;
Make service job easier;
Better trained service personnel;
Improved test equipment and test film;
Professional theater sound service; and
National industry acceptance.

In carrying out the objectives noted above, certain system measurements are required to determine whether the sound system is functioning properly. Among these, the most important are: frequency response, system gain, and power output.

Frequency-Response Checks. Periodically, frequency response, power output and system gain checks are made to determine whether the entire sound system is operating within its prescribed limits. The system characteristics are predetermined by the Academy of Motion Picture Arts and Sciences and the equipments are adjusted during production to meet these specifications; however, minor

Table I. Test Film #45445-3 (35mm) (Special Test Track), Fourth Edition.

Electrical level − 48.3 db
Reference level 0.006 w at 0 db

Freq., c	Length, ft	Correction factors, db
Special Frequency-Response Section		
1000	20	0.0
50	15	+0.1
125	15	−0.3
300	15	+0.1
3000	15	−0.2
5000	15	−0.3
7000	15	−0.1
8000	15	−0.3
Overload Test Section		
50	20	0.0
50	10	+2.2
50	10	+2.2
50	10	+2.0
50	10	+2.0
50	10	+1.9
1000	20	0.0
1000	10	+2.2
1000	10	+1.8
1000	10	+2.0
1000	10	+2.0
1000	10	+2.1
5000	20	0.0
5000	10	+2.0
5000	10	+2.1
5000	10	+2.0
5000	10	+1.9
5000	10	+1.9
Low-Level Gain Test Section		
		Electrical level, db
1000	30	−78.0

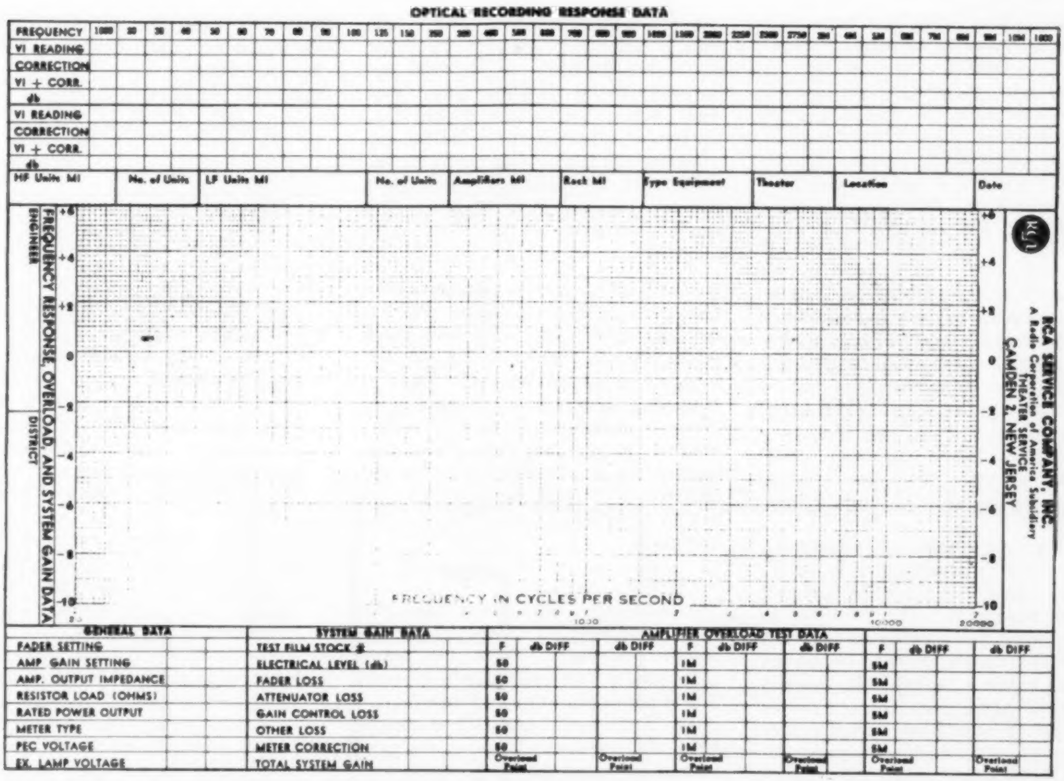


Fig. 5. Form used to record output-meter data from optical recording.

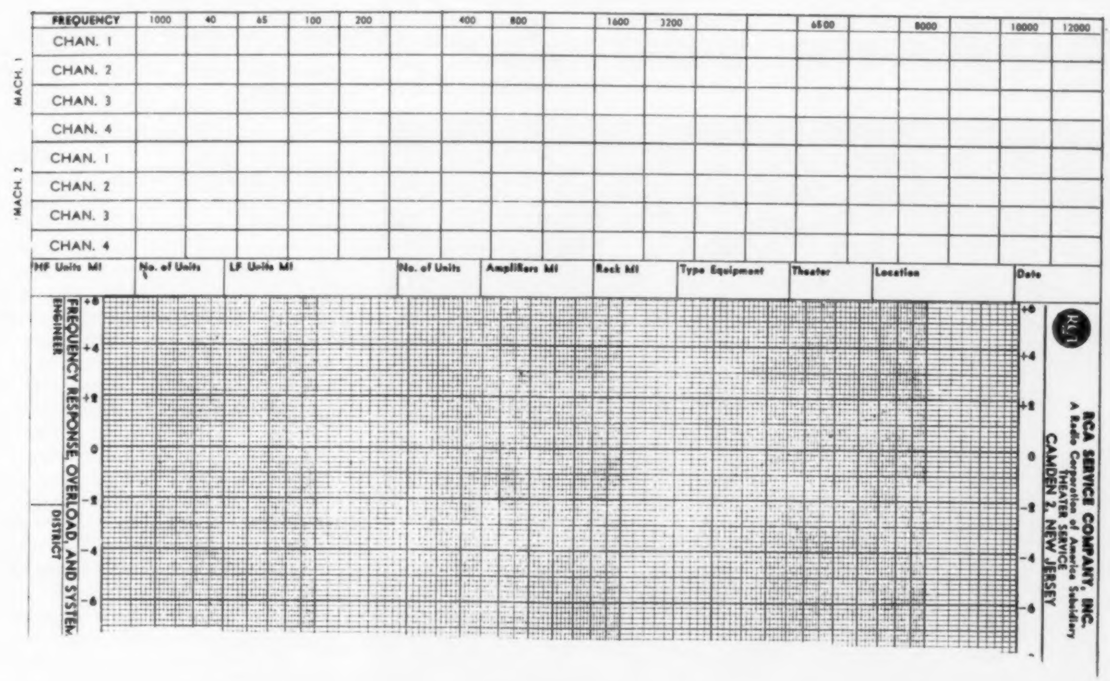


Fig. 6. Form used for making frequency-response and other system checks on four-track stereophonic magnetic soundhead systems.

changes that may be required because of individual theater or auditorium acoustical characteristics are made by the engineer who installs the equipment. The form shown in Fig. 5 is used to record output-meter data from optical recording. The RCA Special #45445 frequency test film is used for this purpose. Tables I and II show the correction factors, electrical level and other data.

System Gain Checks. System gain checks are also made periodically and usually at the same time the overall frequency-response check is made. All these data are entered under "system gain data," from which the system gain is calculated and compared with the manufacturer's specifications. When abnormal deviations are observed, corrective action is taken to restore the system to a normal condition.

A short-type system gain check can also be made by running a −78-db low-level recording with the fader and gain controls wide open. This provides an instantaneous and direct gain reference for the entire sound-reproducing system and can be made by using only a small loop of 1000-cycle film. This test can be made quickly at each service call and usually provides the engineer with considerable information about the relative condition of the system components.

Power Output. While power output can be measured by several different methods the RCA Special #45445 test film is provided with three frequencies, 50-, 1000- and 5000-cycle sections, increasing in level by 2-db increments. The system gain is usually set about 6 db below overload point while the overload section of the film is run through the equipment. Meter observations are made at the output terminals of the system and whenever the level indications vary less than 2 db, overloading is taking place and the overload point of the system can be determined for each of the three frequencies.

Four-Track Stereophonic Magnetic-System Data. For making frequency-response and other system checks on Four-Track Stereophonic Magnetic Soundhead Systems, a special form shown in Fig. 6 is used. This form provides spaces for frequency-response data for each of the four channels on both projectors. This information is used in conjunction with the information obtained on the form shown in Fig. 5, to obtain overall system performance.

Conclusion

In this paper, only a few highlights have been presented on modern theater service procedures. There are many other phases that could not be covered due to their complexity and time limitations. While many articles and papers have been presented covering the production of sound motion pictures, it is hoped that sufficient interest has been aroused by the presentation of this paper, so that some cognizance is given to the personnel who are actively engaged at the other end of the motion-picture business, that which involves motion-picture projection and sound-reproduction facilities.

Table II. Test Film #45445-3 (35mm) (Standard Frequency-Response Track), Fourth Edition.

Electrical level − 48.3 db
Reference level − 0.006 w at 0 db

Freq., c	Length, ft	Correction factors, db
Leader	7.5	
1000	30	0.0
30	11	−0.1
40	11	−0.1
50	11	0.0
60	11	−0.5
70	11	−0.1
80	11	0.0
90	11	+0.3
100	11	0.0
125	11	+0.2
150	11	+0.4
200	11	+0.3
300	11	+0.6
400	11	+0.5
500	11	−0.2
600	11	−0.1
700	11	+0.3
800	11	+0.4
900	11	+0.4
1000	11	0.0
1500	11	+0.4
2000	11	−0.2
2250	11	−0.5
2500	11	−0.4
2750	11	+0.3
3000	11	+0.2
4000	11	+0.1
5000	11	+0.2
6000	11	+0.2
7000	11	0.0
8000	11	+0.4
9000	11	−0.2
10000	11	0.0
1000	11	0.0
Leader	7.5	

Note: This film can be considered to have a flat response characteristic, except when used for transmission runs.

Studio Conversion for Foreign-Language Dubbing

By ARTHUR RESCHER
and JACK CLINK

A description is given of the modifications and new equipment necessary to convert a normal studio recording system to the more specialized requirements of the foreign-language dubbing methods. Construction details are supplied. Additionally, a new dubbing studio, now completed, is described.

From its inception in the Fall of 1950, the Sound Department's aim has been to install equipment that would be flexible and whose various transports could handle any and all film media now in general use. This flexibility was especially desirable because we are primarily a service organization and thus receive recorded material in many forms and sizes.

Equipment was installed to handle 35mm magnetic and optical film, 16mm magnetic and optical, 17½mm magnetic and ¼-in. tape with sync signal. The apparatus was installed in a straightforward manner and a selsyn interlock system was provided for all drive elements.

At the time of the original installation no thought had been given to the use of the studio for foreign-language procedures. As the organization grew, it became increasingly apparent that its location in the Nation's Capital made foreign langauge dubbing a logical service. The multilingual personnel of the Embassies, the Pan-American Union and Government agencies, many with recent experience in the motion-picture field, would facilitate the acquisition of first-rate translators and narrators on a part-time basis.

It is the purpose of this paper to outline the circuitry and modifications resorted to for expeditious adaptation of existing facilities.

Figure 1, a plan of the existing studio and machine area, shows the conventional re-recording studio with the narration room directly to the rear. Back of this is the machine room, and directly over the machine room, a projection booth with both 35mm and 16mm arc projectors.

The auditorium had already been provided with suitable microphone-plug positions throughout the area and it was felt that the foreign-language work would be performed in two studios: a narration room for intimate scenes; and the auditorium for those scenes that required considerable freedom of motion and where a number of actors would be used in the scene.

Presented on April 30, 1957, at the Society's Convention at Washington, D. C., by Arthur Rescher (who read the paper) and Jack Clink, Capital Film Laboratories, Inc., 1905 Fairview Ave., N.E., Washington 2, D.C.
(This paper was received on April 24, 1957.)

Equipment Selection

Because both the magnetic and the picture loops might need to be run many times, it was decided to use the 35mm magnetic channel for this work and, additionally, to use the 35mm projector, not only because of the added strength of the 35mm stock, but also because we felt it would be easier for the actors to follow lip movements in the medium and long shots due to the increased definition of the 35mm picture.

Professional recording equipment does not normally contain an erase head. It was therefore necessary to provide for this in order that the magnetic loop

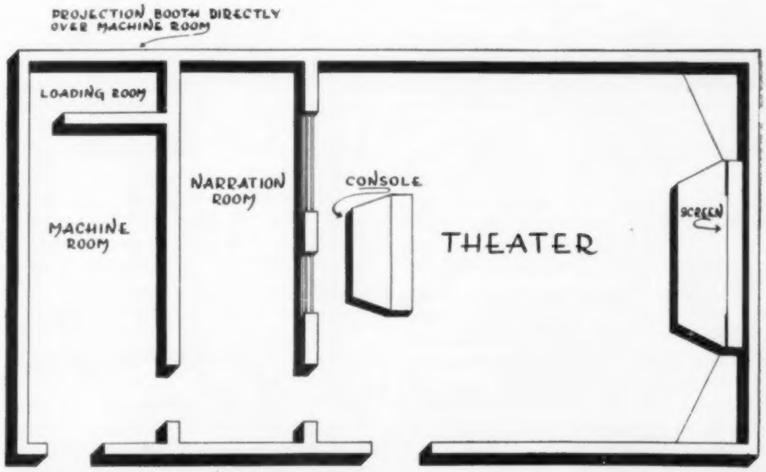


Fig. 1. Plan of the Sound Department.

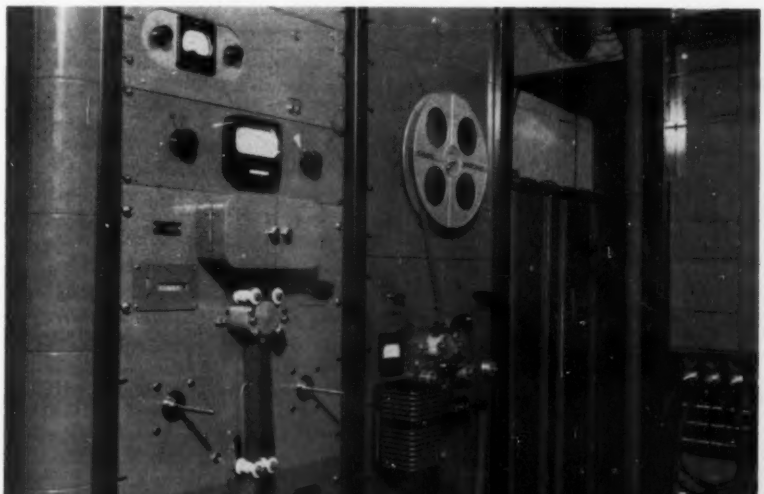


Fig. 2. Modified 35mm record-reproduce equipment with erase panel and loop chute.

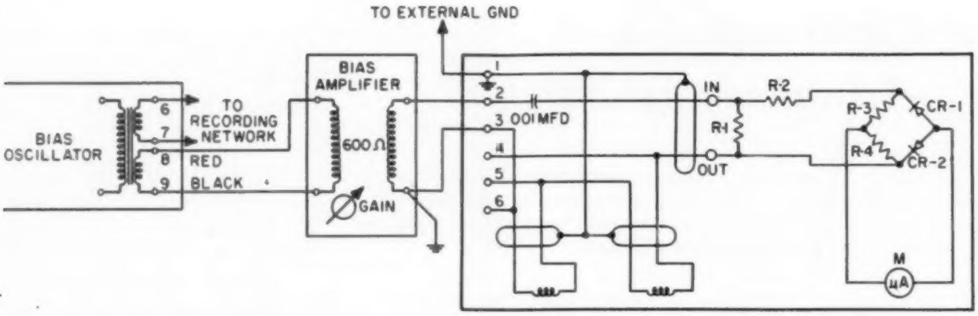


Fig. 3. Schematic of erase circuitry.

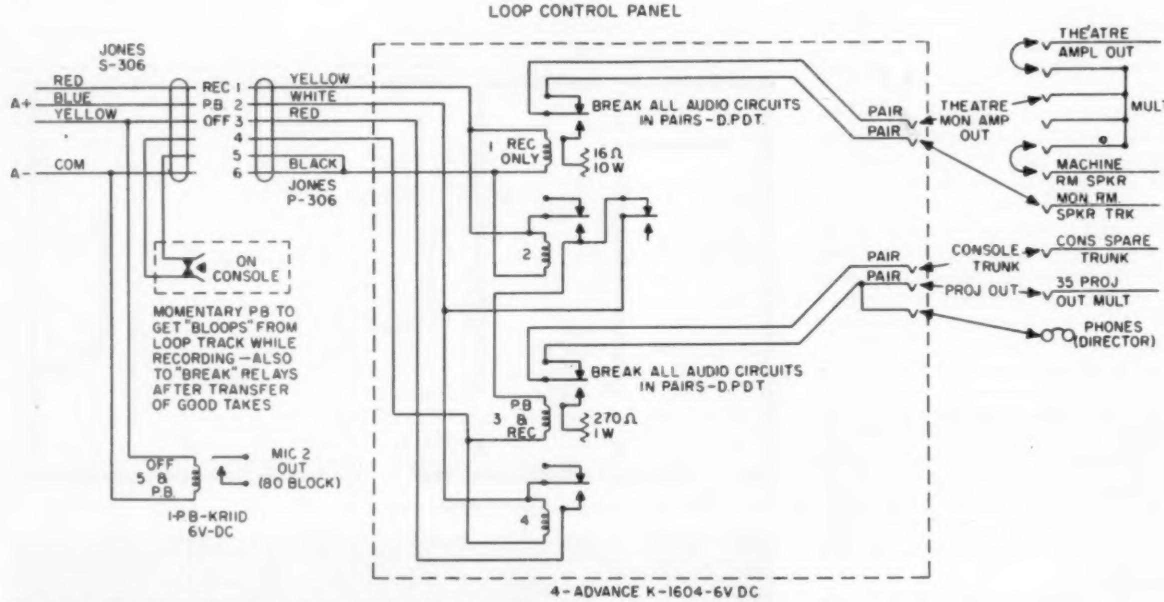


Fig. 4. Auxiliary switching controls for the looping operation.

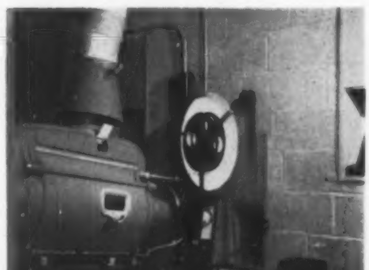


Fig. 5. Projector loop box.

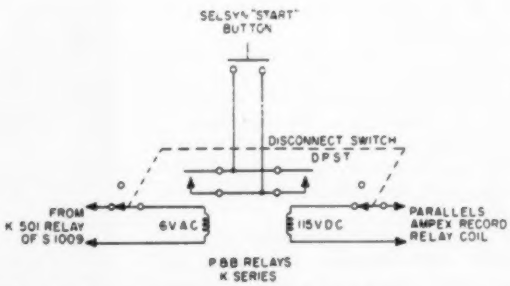


Fig. 6. Selsyn-Rangertone Interlock circuit.

might be automatically erased each time it passed through the machine, prior to recording the new take. A suitable unit (Fig. 2) was supplied by Radio Corp. of America. This assembly is mounted immediately below the record-reproduce panel and just above the loop chute.

This loop chute is a very simple device constructed locally. It consists of a hinged box, 35mm plus approximately ⅛ in. wide with other dimensions simply designed to fit the front of the rack from the erase head to the base plate. A small guide is installed to prevent chafing of the stock.

With reference to the erase requirement, both RCA and our engineering personnel felt that an independent oscillator for the erase heads might lead to difficulties in that the erase frequency could beat with the bias-oscillator frequency. Therefore, provision was made

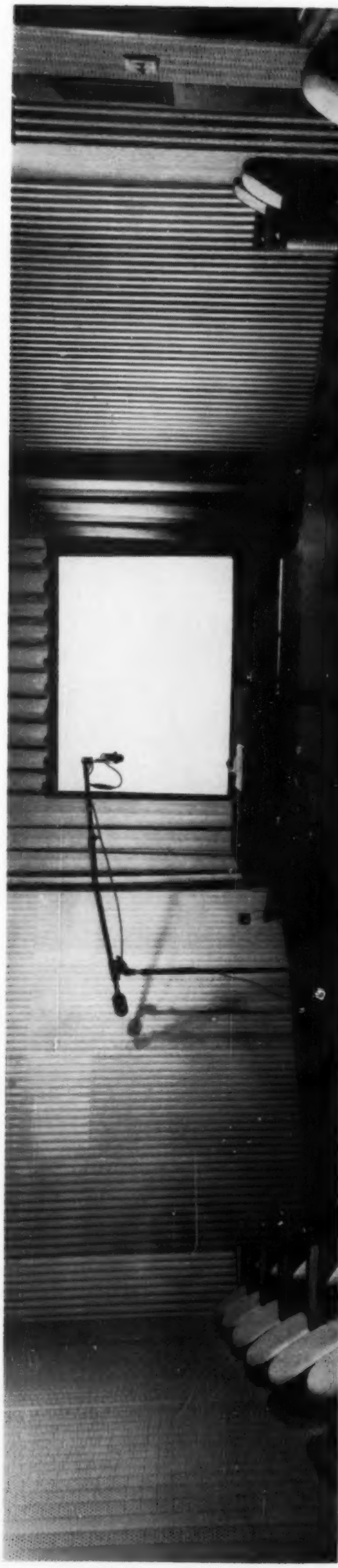


Fig. 7. New Studio for foreign-language and narration work at Capital Film Laboratories, Washington, D.C.

to replace the existing bias-oscillator coil with a new one equipped with a tertiary winding. As the secondary winding is conventionally fed to the recording network, the tertiary winding is fed to an erase amplifier. The device selected is a McIntosh 30-w power amplifier, normally used in high-grade home audio systems. The bias frequency of 68 to 72 kc is therefore fed to this erase amplifier which in turn provides sufficient power to drive the erase heads at the frequency identical with that of the bias oscillator. Figure 3 is a schematic of this part of the circuit.

Switching Requirements

A high-quality theater-type speaker system had already been provided in the auditorium. It was, therefore, necessary only to equip the narration room with a good speaker and to provide suitable switching equipment and suitable interlocks in order to prevent accidental feedback. In operation, the original optical track is usually heard for a few runs in order to familiarize the new actors with the delivery and timing of the original track. They may hear this track in either the theater or the narration room. With switches in this position, the microphone inputs are automatically shorted.

After an interval, the director usually calls his first rehearsal in the new language. One switch is thrown to record mode. When the switch is actuated, the microphone circuits are normalled through. The narration-room speaker is switched out, a suitable dummy load resister is placed in the line and the original track is lifted from the console. Normal procedure in this type of work utilizes a bloop which is affixed to the Academy leader used in every loop. We use Academy #3 mark for this purpose. A momentary pushbutton is mounted at the console for use by the mixer so that when the leader is on the screen, the mixer may use the pushbutton to insert the bloop onto the magnetic loop. The pushbutton simply overrides the relay interlocks. The relay assembly (Fig. 4) is mounted in an aluminum shelf assembly located in the machine room.

Projector Modifications

The 16mm and 35mm equipment consists of Simplex mechanisms with Peerless Magnaarc lamps. The original intent was to construct a very makeshift chute box to replace the lower magazine. It was also intended, when time permitted, to come up with something better from the standpoint of both appearance and interchangeability with the normal lower take-up magazine. Like many similar projects, the temporary box was placed in service, worked fine and we have never gotten around to improving it. Figure 5 shows the projector with the loop chute attached. Film is led out of the chute through a small roller and fed back through the upper magazine.

In operation, the projectionist thread up anywhere in the Academy leader; meanwhile, downstairs, the machine-room operator threads his loop with the splice in the region of the record head. The splice procedure is emphasized because it is a simple method of preventing the significant portion of the loop from being recorded over the magnetic splice. As long as projector and recorder are locked on the line, the two splices will remain in approximate sync.

Monitor Facilities

A pair of headphones is provided for the director in order that he may hear the original track while his people are recording loops in the new language.

Operating Procedures

When a director believes his cast is achieving proper synchronization, he will call for "record." It should be stressed here that from this point on each rehearsal becomes a potential printed take. Each time the loop goes through, the actors speak their lines. At the end of the loop, should a director feel that the results are satisfactory, he calls "playback" over the open microphone. When "playback" is heard, the master switch is placed in that position. The relays drop in and the newly recorded loop plays back over all monitors. Director and cast will then critically appraise the work. If the director feels that the take is satisfactory, he asks for a transfer. The loop is then transferred to another medium. Suitable loop identification is made at this time. If the results are less than satisfactory, the director calls for "record" and the process is repeated.

Music and Effects

It happens frequently that music and effects tracks are not available for some of the subjects. It then becomes necessary to improvise and to construct new tracks. Fortunately, there are many instances where certain sync effects and musical passages are laid in, "in the clear." It is a simple matter then for the mixer to throw a key on the console at the proper time and inject the wanted portion into the loop while the new lines are spoken. This part of the job is fun in an otherwise rather humdrum routine. Apart from being fun, it saves our Editorial Department hours of additional labor.

When significant effects are not "in the clear," we attempt to duplicate the effect in the recording room. Such simple things as the clatter of china on the table, or pulling up a chair, and so on, are easily accomplished at this stage. Additional measures are taken to preserve the illusion of audio perspective. When the actor on the screen turns away from the camera, the new actor in the recording room performs a similar movement. The movement, however, is with restraint.

Fig. 8. Combination take-up panel and loop chute.

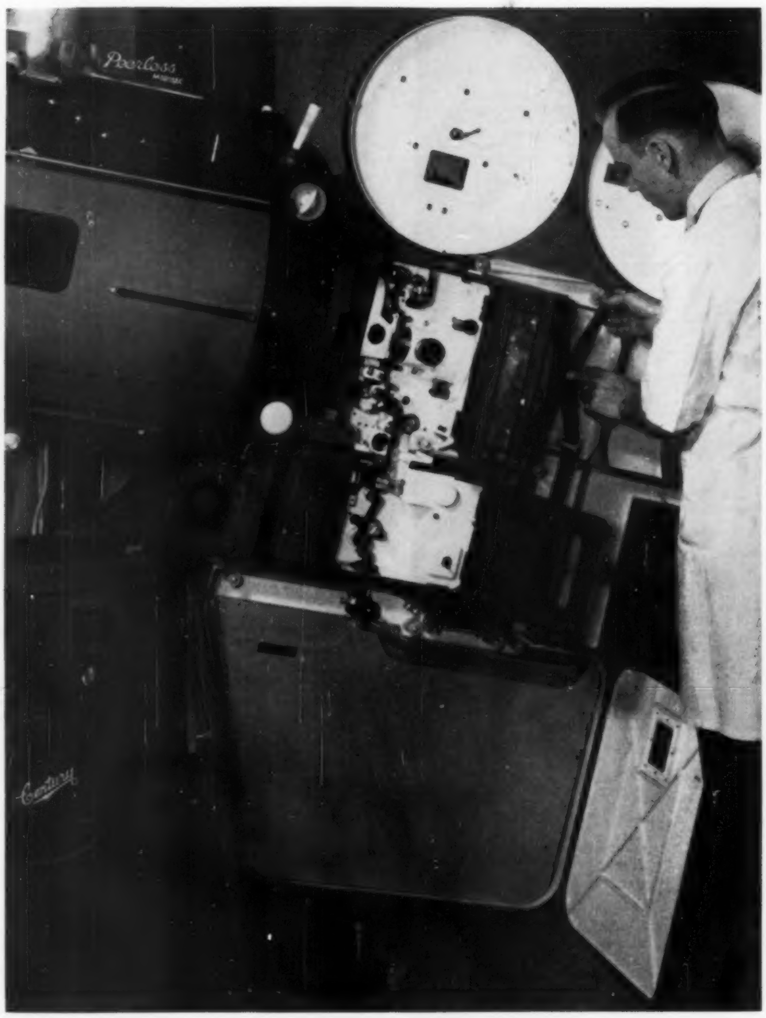


Fig. 9. Century 35mm Projector with Westrex loop and preview attachments.

As we all know, a monaural system exaggerates this off-mkie technique.

Rangerlock

We have a little gadget, a very simple device, the use of which is not involved in foreign-language work, but a mention of it here might prove useful. Its purpose is to provide immediate playback in sync with picture from ¼-in. material.

We use ¼-in. tape as a protection material on all mixes and on some transfers. Rangerlock is essentially a device for marrying ¼-in. tape to our selsyn system. Leads are brought out from the sync signal relay of the Ranger synchronizer. Leads are fed to a small control panel at the recording position. The circuit of this is shown in Fig. 6. Voltage is fed to the control panel at the instant the Ampex record switch is energized. As the record circuit is closed, a relay on our little device is energized and the contact circuits are paralleled across the selsyn start line. Thus, all dummies and the projector will start to roll at the moment the sync signal is fed to the tape.

When a mix is completed, if the client wishes to hear an immediate playback, this can be accomplished just as fast as the film can be rewound and rethreaded in the projector. The operation is as follows: The ¼-in. tape, having also been rewound, is started through the machine. At the point where the start of the sync signal previously applied reaches the pickup head, the synchronizer relay is pulled in. This, in turn, energizes the relay on the panel and the selsyn system again takes off in the same relationship to the tape. There is no direct lock, since we are at the mercy of friction variables in the various machines between the rest state and full speed; however, we are usually "in sync" right to the frame. The device costs practically nothing to install and it does save some time and effort.

New Studio

Because efforts in the foreign-language work are time consuming and therefore interfere with the other more conventional duties of the Sound Department, a new studio (Fig. 7) was built primarily to remove this heavy load from the existing facility. Because the control console was designed for foreign-language and narration work, as opposed to re-recording, it was placed outside the studio. Both floor and walls are floating in order to obtain proper isolation. It was found in the planning stage that the four studio walls could rather easily be so shaped that parallel surfaces were avoided. The odd shape was worked into an irregular corner of the expanded plant and the studio acoustics are expected to be quite good.

The Westrex magnetic record-reproducer was especially modified for foreign-language work. Here the erase head was mounted a little closer to the record head than the older channel. This permits more identification information on the leader before the first scene is reached on the loop. The erase head is driven directly from the bias oscillator. Synchronous drive with the projector is obtained through the control panel whose bus #2 switch allows locking into the main selsyn distributor as well as the normal projector-recorder interlock.

Finally, the loop chute on this recorder is designed in combination with the

take-up portion of the assembly (Fig. 8). The top portion hinges out and a spindle is available for take-up purposes on conventional runs. When looping is being performed, the guard assembly is swung out to face 90° from the front panel. Closing the top of the chute locks the guard assembly in position. Thus, the convolutions of the film are prevented from contacting the take-up spindle.

The projection room will be equipped with two 35mm and one 16mm projectors. One of the projectors has already been installed (Fig. 9). It is a Century mechanism with Westrex soundhead. The lower magazine is a Westrex studio attachment which not only permits performing the looping operation conveniently, but also allows utilizing a track loop in the projector proper for possible use in post-synchronizing. When the projector is used as a normal screening device, the inner shell is removed from the take-up compartment and spindles are inserted in their stead. Thus, conversion from looping to film-reel operation should be quick and dependable.

Acknowledgment

We would like to acknowledge gratefully the most helpful assistance contributed by George Lewin of the Army Pictorial Center. Mr. Lewin has previously presented a paper before the Society on this subject,* and the modifications here discussed, with his help, have been adapted to our particular needs.

(At the end of this paper at the Convention, the authors showed a clip from a feature film originally recorded in German and converted to English.)

* George Lewin, "Magnetically striped loops for lip-synchronizing production," *Jour. SMPTE*, 62: 409–418, June 1954.

Discussion

George Lewin (Army Pictorial Center): Regarding the splice in the loop, for quite a few years we have been quite successful in using a butt-weld splice so that we don't have to worry about where the splice is and just let the loop keep running continuously. That saves quite a bit of time because we don't have to stop and reset the loop.

Mr. Rescher: We have never used a butt-weld splice. Actually, we find that our technicians normally are waiting more often for the creative side of the team than the other way round, and it is a very simple matter for us to align these loops. This has not been a problem but I certainly do agree that we could disregard splices if we used the butt technique.

Mr. Lewin: You do not use two projectors?

Mr. Rescher: No, we do not.

Mr. Lewin: With the two projectors, we like to keep changing over from one to the other to save time and it makes it a lot easier if we don't have to stop the loop as we change from one projector to the other.

Mr. Rescher: I can well understand that. In this older studio we have only the one 35mm. We plan to have two projectors in this newer studio that I showed you.

A Self-Contained 16mm Post-Synchronization Studio

By J. P. SEABOURNE

Because of a multiplicity of languages in Europe, stripe recording has many obvious applications; however, with existing equipment it would be very expensive and complicated to install key centers for high-quality recordings and the making of copies. The paper describes a self-contained recording studio designed to meet these needs, and which also might have many applications in TV for the post-synchronization of foreign-language versions.

The European Productivity Agency started its investigations into the application of stripe recording to a large-scale program some two years ago. Among the many problems inherent in such a project, recording and transfer equipment is one of the most important. Two fundamentals of any large-scale program are adequate studio installation and a means of "breeding" duplicates of recordings. In Europe where, because of the multiplicity of languages, the studio installation would have to be duplicated in several countries, the cost factor is of great importance. It is also desirable to have an equipment which can be installed easily and operated by someone who does not have a profound technical knowledge. Turkey and Greece, for example, have very few experienced sound engineers. High-quality recording is of paramount importance. Often, because of very poor projection conditions and lack of projector maintenance, a falling-off of standards of intelligibility is soon reached with all but top-quality recordings.

The equipment requirement for an ideal studio might, therefore, be expressed as — a *self-contained* unit of reasonable size and weight providing the following facilities: (1) high-quality synchronous recording on 16mm magnetic film using either axial or marginal tracks; (2) double-head projection; (3) forward and reverse running of recording and reproduction panels in interlock with instantaneous start and stop; (4) two-channel mixing (minimum); (5) test equipment; and (6) facilities for transferring recordings from a master copy to other copies with audio monitoring and metering. So as to be able to check the synchronism of transferred recordings where direct dialogue is concerned, it must be possible to monitor the transferred copy from the reproduction head on the projector.

The machine must be of robust construction to withstand rough handling but, at the same time, the highest possible mechanical precision is essential to produce the sound quality required. No useful purpose would be served in constructing a machine which did not represent an advance in sound quality and an improvement in recording technique.

Believing that these requirements represented the basic needs of an ideal 16mm post-synchronization setup, the EPA prepared specifications for a suitable unit which was custom-built* for installation in the Productivity Centre in Athens, Greece. The machine is shown in Figs. 1 and 2. In Greece there are no conventional 16mm recording facilities. It will therefore be an ideal testing ground for the machine. Once the Greek Centre has obtained the striped prints of the films it needs from EPA, Paris, it will be able to operate its program independently, without assistance from outside sources.

Operation of the machine is very simple. A block diagram of the system is given in Fig. 3. A striped copy of the film to be recorded is loaded on the projector which, during recording, serves only to provide picture. A 16mm magnetic film of the suitable length is threaded on the record panel. Start marks are provided on both the striped copy and the magnetic film to permit easy establishment of synchronism later. The reel is recorded in the normal manner, making use of the forward and reverse switch as necessary.

One of the obvious advantages of such a machine is that it avoids the use of an expensive electrical interlock system, and

Presented on April 30, 1957, at the Society's Convention at Washington, D.C., by J. P. Seabourne, European Productivity Agency, Audio-Visual Aids Section, 3 rue André Pascal, Paris 16, France.
(This paper was received on April 16, 1957.)

* By Bomar s.r.l., 21 Via Seneca, Rome (Engineer Bottini).

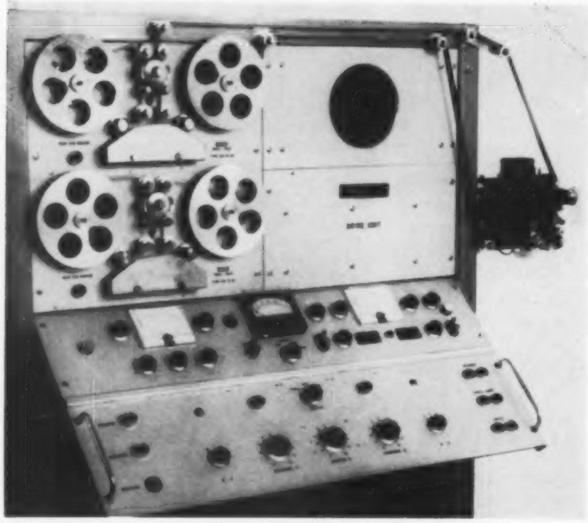


Fig. 1. The units ready for use and loaded for transfer. Monitoring of the copy is effected from the magnetic head on the projector.

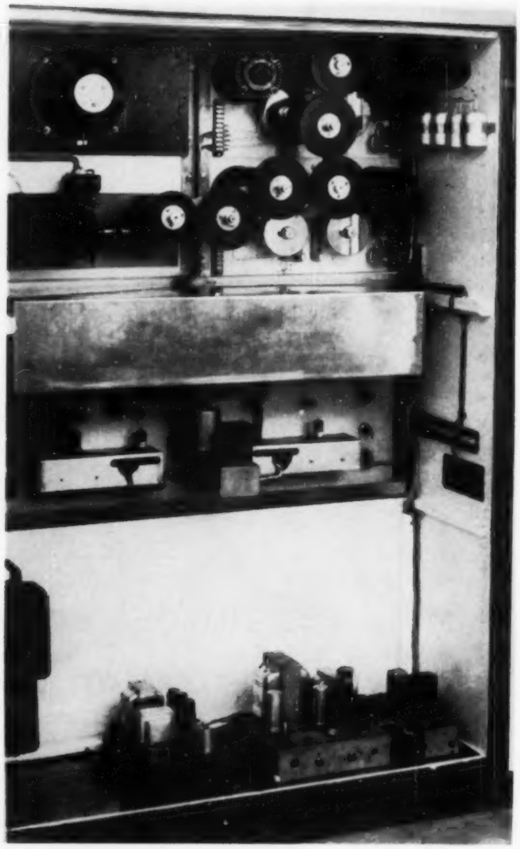


Fig. 2. A general view of the interior.

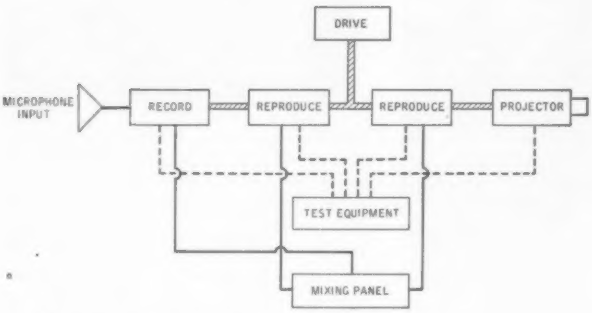


Fig. 3. Schematic of the system.

permits the synchronous starting and stopping of projection, recording and reproducing equipment. The possibility of running all units forward and backward in mechanical interlock also speeds up production work in the studio.

Reproduction of optical sound on the projector can be provided to facilitate post-synchronization of direct dialogue, and, for this purpose, an attachment for running loops of up to 20 m (60 ft) can be used. During some recent experimental recordings carried out in Bruxelles, the technique of using two machines simultaneously was used. While machine A was running forward, machine B was running backward to the start mark on the section being recorded. By this means, as soon as the end of the sequence being rehearsed on machine A had been reached, machine B was ready to start, so that no studio time was lost. With very efficient operators, the system proved almost as good as using loops.

In all cases, magnetic recordings are made first on the 16mm film using either an axial or marginal track of SMPTE standard. This recording serves as a master and the signal it carries is subsequently transferred to striped copies. The master is also held as a safeguard against accidental erasures of recordings. The risk of accidental erasure is, however, found to be much less than was generally anticipated.

For transferring of recordings from the master to other copies, the master is loaded on the reproduce panel and the striped copy on the record panel. Where lip-sync or commentaries in which the synchronism is critical are concerned, the copy can, after receiving the signal from the record head, be led across the face of the machine and then fed into the projector. The projector, fitted with a magnetic reproduction head, makes it possible to monitor the transferred copy in sync with the picture. In this way, missing frames or other defects in the copy, which might throw it out of sync in relation to the master, are immediately evident.

In addition to the possibility of audio-monitoring the copy either from the reproduction head on the record panel or from the reproduction head on the projector, a selector switch on the control panel allows audio comparison of the recording on the copy with that on the master. Comparison is also possible on the VU-meter, which operates during both recording and reproduction. Two-channel mixing has been provided on the first model, which allows mixing from the microphone input and from the reproduce panel.

For mixing purposes, the 600-ohm microphone input can also be used to receive the signal from a pickup or tape recorder while the dialogue track is carried on the reproduce panel. On subsequent models, a second reproduce panel will be provided (Fig. 4) to permit mixing from two tracks — dialogue, and background track — and the microphone input, if a third channel is necessary. Other refinements will include a talk-back system and a jack panel.

The test panel consists essentially of an audio-oscillator and an intermodulation distortion analyzer with their associated inputs, outputs and potentiometers. In addition to allowing a check of the frequency-response curve and measurement of distortion, all the other tests normally associated with professional

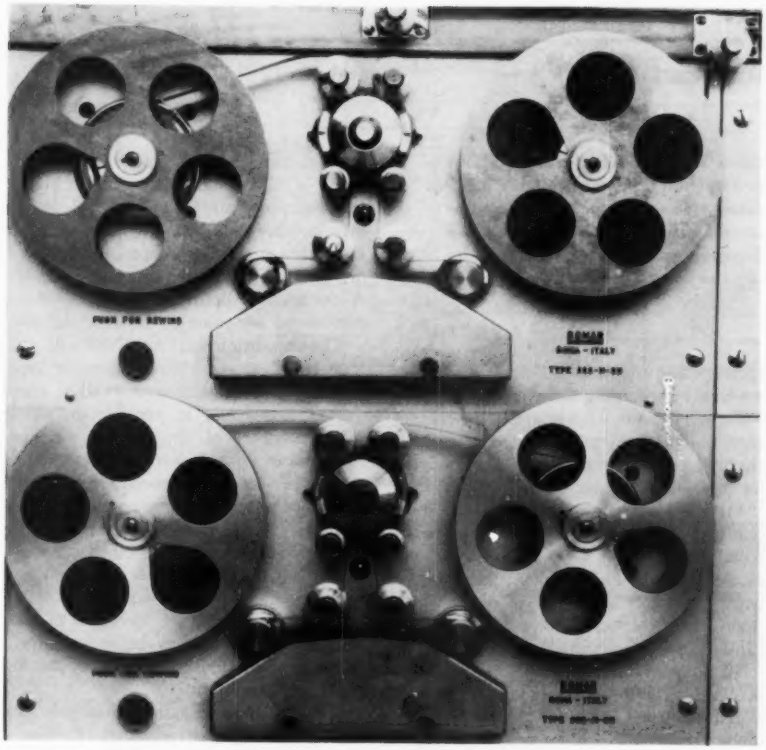


Fig. 4. The reproduce panels.

equipment are possible. With the exception of the reverse switch, all the controls are of the pushbutton type and circuitry is such that the machine cuts out in the event of faulty manipulation. Similarly, it is impossible to apply current to the projector lamp when the drive unit is not in operation.

The basic units of the machine — record panel, reproduce panel, amplifiers, bias and erase oscillator, power supply, etc. — have been designed to be self-contained and interchangeable. Hence, apart from changing a tube in the event of failure, maintenance is reduced to the interchange of standard units. SMPTE standards have been respected throughout and mechanical tolerances have been set to the minimum. For example, all shafts have been fine-ground to a tolerance of 0.00025 in.

One of the advantages of the "self-contained recording studio" is that there is no installation problem. Installation consists of plugging the machine into the power supply. When not in use, the projection unit can be removed and stored in the lower compartment of the recording machine which is then closed and locked. Although on the record and reproduce panels the length of reels has been purposely limited, when used for projection of combined prints the machine can accommodate 360-meter reels. The performance of the machine compares favorably with that of other high-quality professional recorders, as can be seen by the following characteristics:

Frequency response: 50 to 12,000 cycles/sec $\pm$ 1 db.

Distortion: At reference recording level 1.5% total rms harmonic distortion at 400 cycles/sec.

Output: 600 ohms; distortion of reproducing amplifier less than 1.5% at 400 cycles/sec; gain control continuously variable.

Signal-to-noise ratio: −40 dbm terminated input.

Total flutter: 0.15%.

Although this machine has been built to meet the specific needs of the EPA Visual Aids program, such a machine may have other applications, particularly for television purposes.

In encouraging its member countries to make use of magnetic-stripe recording for their film programs, the EPA Visual Aids Section hopes to be able to solve many of the problems existing in Europe relating to sound quality in the 16mm field and also to simplify the very complex procedures of running a wide-spread film program. The overall program of the EPA, in fact, consists of a number of individual programs — one for each language — with the EPA Headquarters in Paris obtaining and supplying films and serving as a research and technical advice center.

It will be appreciated that in such an organization magnetic stripe recording offers many advantages. Of course, during the changeover period from photographic to magnetic recording, the major problem will be the vast number of projectors in Europe which are designed only for the reproduction of photographic sound. This problem will be met by the supply of magnetic adaptors which can be fitted to optical machines; the changeover will be completed by the replacement of old machines by new magnetic machines. It is the writer's belief that in Europe, at least, stripe recording will one day be the universal 16mm system.

Discussion

Peter Keane (Screen Gems Inc.): With the projector on the side of that equipment projecting the picture for lip sync, how do you get rid of the projector noise?

Mr. Seabourne: We just took an existing projector and considerably modified it to make it as silent as possible, but we used the whole of the machine in a cabin isolated from the auditorium. However, the amount of noise is negligible so it's not a very difficult problem.

Mr. Keane: Then further, you tried using two machines, winding one backwards while you were doing work on the other so as to avoid the making of loops and thus save a great deal of time. How did you keep track of the recordings made since, I believe, the recording could be made on either machine?

Mr. Seabourne: We recorded on one machine, only using one more run if necessary so as to record always on "A."

Mr. Keane: Did you have any problem with the synchronization when you were using picture on 2 with recording on 1?

Mr. Seabourne: None at all. We just agreed mutually how much we would tackle — one sentence, two sentences, three sentences — or whatever the artist thought he would like to do — the operator was in on the decision and then we ran that sequence forwards and backwards alternately on machine A or machine B, but always recording on machine A.

Mr. Keane: Are these machines made available for other than your own department's usage?

Mr. Seabourne: Yes, the machine, we feel, would have many uses.

George Lewin (Army Pictorial Center): Do I understand correctly that your entire reel is not cut; you work with the entire reel but you record short sequences. Then you proceed to the next sequence so that you have a succession of short takes on the one reel.

Mr. Seabourne: That is correct.

Mr. Lewin: But then if you don't like the tape that you make, you erase it and do it over again?

Mr. Seabourne: Yes. It needs some practice on the part of the operators, I have recorded 50 or 60 films now in this way and in a number of languages, including Greek and Norwegian. One does find with untrained artists that levels tend to vary greatly and when you run a complete film you want to re-record or re-take just one phrase. This is quite possible because one of the requirements we foresaw was instantaneous stopping and getting up to speed in 3 to 4 frames.

Mr. Lewin: Don't you have a series of rather loud "bloops" between sequences?

Mr. Seabourne: No, as you heard, there were no clicks in this copy which was, incidentally, a third generation — a copy from a copy.

Mr. Lewin: Could you tell us, just roughly, what is the average length of take that you make successfully?

Mr. Seabourne: The last film I recorded with these particular artists was in Belgium and we were taking up to something like 45 or 50 seconds at a time.

Automatic Printer Operation From Punched Tape and Punched Cards

By H. M. LITTLE
and H. L. BAUMBACH

Standard punched-tape units have been recoded and modified to bring about automatic operation of film-printing equipment. Punched tape performs the functions of discrete scene-to-scene light changes, dissolve shutter operation and automatic stopping of equipment, while cards automatically adjust light level and printer characteristics for any particular job. Complex printer operations may be performed with great accuracy at high speeds by the use of these items.

The functions of automatic printer operation have been in use in the motion-picture industry for a considerable number of years. In particular, the automatic selection of scene-to-scene exposure values has been performed by the use of pegboards, punched films, traveling mattes and other attenuating devices.

In each case, very specialized equipment is required and usually the preparation of the printer program material is costly and very time consuming.

Other industries have made extensive use of punched paper tape and its associated equipment for recording and programming data, as an expansion of the long-time use in telegraphy. Standards have long been established for this tape and much of the equipment for handling it is readily available on the open market.

It is the use of this tape in an extended area of automation in printing-machine operation that is the subject of this paper.

Paper Tape and Associated Equipment

Paper tape is available in standard five-, six- and eight-channel form; only the width of the tape varies with the number of channels. Punches prepare their own holes, even those for the tape-feed sprocket and the rows of holes are spaced ten to the inch along the tape.

Figure 1 shows a keyboard and perforator capable of producing an eight-channel tape. The keyboard is encoded for automatic printer operation.

Figure 2 illustrates one type of tape reader currently being manufactured which will accept five- through eight-channel tapes. This reader makes electrical contacts internally, depending upon the presence of holes in the tape, rather than through the holes themselves.

The paper ribbon used for this purpose is oiled and is quite strong. Even the inexpensive tapes may be run through a reader hundreds of times before damage occurs. For exceptionally hard usage, a very sturdy black fiber tape is available.

Printer-Control System

In establishing a system or printer control with paper tape, it was decided that five of the channels (the standard five) would be used for intensity-change information. With the simple binary system these five channels are capable of storing 32 separate bits of information, For electrical reasons, the conditions of "no holes" and "all five holes" were set aside, leaving thirty remaining combinations.

Printer-point light values were chosen in which channel 1 provides one point of change, channel 2 gives two points, channel 3 is four points, channel 4 is eight points and channel 5 is sixteen points. When a combination of holes is present, the printer-point result is the sum of the channels involved. The total range of thirty points provides an eight-fold light-intensity range of 0.03 log E increments. This range will encompass most films encountered in motion-picture or kinescope recording photography. A twenty-two point range is no longer considered adequate for commercial use.

The condition of "no holes" in the tape is, of course, characteristic of tape leader. This situation is readily connected electrically to provide an automatic advance of the tape to the first light value — a feature of great value under the poor light conditions characteristic of photographic darkrooms.

When all five channels are present in the tape, another simple electrical condition is satisfied, and this condition has been chosen to bring about a halt in the printing operation. By insertion of this code, the machine may be programmed to stop at any desired position in the sequence of operation.

The five-channel system thus provides an automatic tape advance, a thirty-printer-point light-intensity range and an automatic stop. Many pieces of photographic equipment can be adequately programmed with these five channels of operation.

Some printing operations, however, also require the use of a fade (or dissolve) shutter. The art of A and B printing is gaining in favor because of the improved photographic quality resulting from its use.

In A and B printing, two separate rolls of negatives are so cut as to permit the printing light to be gradually extinguished on the scene of the one roll, while it is gradually allowed to come on during the subsequent printing of the following scene on the other roll. Proper timing of this dissolve shutter operation brings about a smooth, gradual transition from one scene to the next. Additional tape channels make it possible to bring about automatic shutter operation as well as light-intensity selection. For

Presented on October 9, 1956, at the Society's Convention at Los Angeles by H. M. Little (who read the paper), and H. L. Baumbach, Unicorn Engineering Corp., 1040 N. McCadden Pl., Hollywood 38.
(This paper was received on June 21, 1957.)

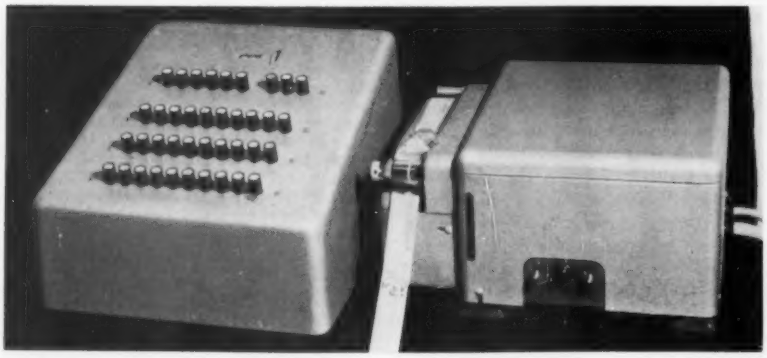


Fig. 1. Keyboard and perforator.

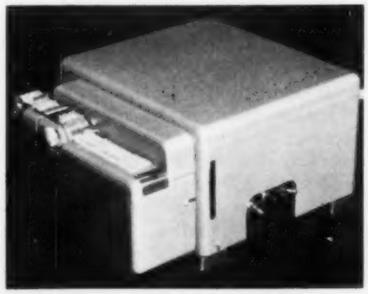
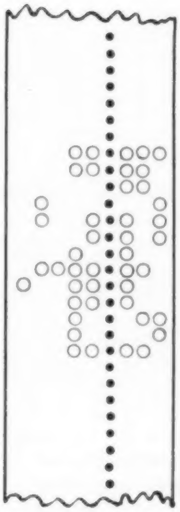


Fig. 2. Tape reader.



Scene	Light Points	Shutter—Frames	
12	15		
13	17		
14	25		
15	7		
16	7	Closed	48
17	15	Open	64
18	5		
19	22		
20	22	Closed	32
21	16	Open	32
22	12		
23	15		
24	Stop		

Fig. 3. Eight-channel tape program.

example, eight-channel tape provides at least six different lengths of fades, such as 16, 32, 48, 64, 96 and 128 frames, in addition to light-intensity values and the feed and stop features.

Because both light and fade information are present in the same tape, it becomes possible to use the same film cuing device for both purposes, thereby eliminating the need for a separate cue roll or separate cuing mechanisms. The cuing device may be the usual notch in the negative or it may be an adhesive conductor patch, or a magnetic patch. In use, the negative cue advances the tape so that the five-holed information supplies the modulator with desired light intensity, and the sixth, seventh and eighth holes supply fade-length information. If a light change is desired without a fade, the tape is punched with only light information. When a fade is desired without a light change, fade information is programmed and the previous light information is simply repeated.

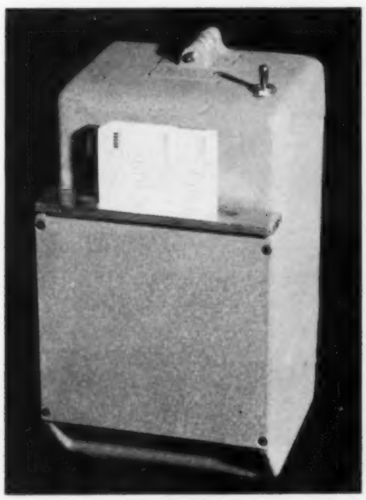


Fig. 4. Static card reader.

Figure 3 illustrates an eight-channel tape program for light intensity and shutter operation.

The electrical information secured from the tape reader can be used for various types of light modulators. In slow-speed printing equipment, the coded electrical information can simply cut resistor banks in and out of the lamp electrical supply and bring about the desired changes in the lamp intensity.

The tape reader may likewise bring about rapid insertion and withdrawal of neutral-density filters in the light beam by feeding electrical information to solenoids.

A third adaptation involves the decoding of the electrical information by the use of an electronic computor which in turn feeds a servo mechanism bringing about rapid and accurate positioning of the printer light-selection lever on the Bell & Howell Models D and J printers.

It is apparent that channels 6, 7 and 8 can be used for other specialized features, such as the cuing of color-printing information relative to red, green, and blue modulators, or the automatic operation of aperture devices.

Punched Cards

While punched cards are not especially satisfactory for sequential operation of light-change information, due to the limited number of scenes which may be accommodated, they are very useful in performing other printer adjustments. In order that the same punched tape may be used for printing on films of different sensitivity, it is convenient to perform an overall light-intensity adjustment by means of information present in the card.

The system is especially useful where punched cards provide the "paper work" associated with each print to be made, since correct printer setting can be automatically programmed for the job.

Six channels of information are reserved on the cards for printer control. The 64-point light range thus provided in the card satisfies the full range of printing emulsions encountered in practice, bringing about an automatic light-level selection.

A static card reader, shown in Fig. 4, has been designed to convert the punched data into electrical information.

Information punched into the card automatically operates other devices, such as those involving edge lights or the insertion of special filters.

In certain cases information present in the card prevents the starting of the printing machine if proper printing conditions cannot be met by the particular machine.

Advantages of the Tape System

In practice, the preparation of a punched tape is a very simple operation. Light values are encoded as fast as each key can be depressed, and a counter keeps track of the number of scenes. There is no limit to the length of the tape or to the number of scenes which may be present. So much information is placed in the tape that even a half-hour television show rarely requires more than a three-foot length.

The tape is ready to use immediately. It is threaded into the tape reader within the "no hole" condition without regard to the location of first-scene information. The punched card is likewise placed in the slot of the card reader. Operating a switch brings about automatic printer light-level setting and the tape automatically advances to the first scene programmed. After the film roll is printed, the machine shuts off automatically where desired. In this way, important sound-synchronizing information cannot be lost.

The tapes are readily stored with the negatives, where they are always available for identical repeat print orders.

Tape readers operate so rapidly to set up new information that the presence of short scenes in the cut negative is not a problem. Moreover, a complex printer change is performed as rapidly as a simple one.

In a complex operation such as A and B printing, the operator gains a better personal accuracy record because he does not have to read occasional poor pencil writing in safelight illumination while he is setting two dials. The tapes are prepared in normal room light by an operator who can clarify questionable information before recording it on the tape.

The servicing of tape-handling equipment can be performed on the test bench, since the units are readily unplugged and exchanged for duplicates.

Tape equipment is available at relatively low cost, since it is manufactured in such large quantities for other industries. Replacement parts are readily available and are well standardized.

A 16mm Process Control Sensitometer

By GEO. W. COLBURN

This report describes a sensitometer of the intensity-scale type which exposes a full 16mm frame for each density step. The light source is modulated by a series of apertures giving log E steps of 0.10. The unit is capable of exposing a single strip of 24 frames or a continuous roll of strips 200 ft in length.

The need for a fast, convenient, dependable method for exposing sensitometric processing control strips is responsible for the design and construction of this instrument.

Mees[1] states: "The only sensitometer which can be expected to give results corresponding to those obtained in practice is one which permits a continuous exposure at an intensity level and, therefore, of a duration approximating that obtaining when the materials are used in practical work." An attempt has been made to fulfill these conditions. Film is exposed to tungsten light of the same quality used in the printer or recorder. The exposure is continuous and has a duration of a fraction of a second. The area covered in exposing and developing is the same size as in actual practice.

The following specifications were kept in mind as most important, that this instrument:

(1) shall automatically expose at least 200 ft of sensitometric strips;

(2) shall operate from 117-v, 60-cycle utility outlet;

(3) shall have no optical parts to keep clean or adjust;

(4) should be of intensity-scale type with normal exposure of 1/5 to 1/100 sec;

(5) should handle all types of 16mm film from the fastest to the slowest emulsion (color internegative); and

(6) should be simple to maintain.

A single 16mm frame was chosen for the area of each density step. Thus the instrument is actually a 16mm step printer with conventional feed and holdback sprockets and film magazines.

The frame advance, which we shall call a "lazy D pick" movement, consists of a straight piece of ground flat stock,

Presented on December 13, 1956, at the Chicago Section Meeting and on May 1, 1957, at the Society's Convention at Washington, D.C., by Geo. W. Colburn, Geo. W. Colburn Laboratory, Inc., 164 N. Wacker Dr., Chicago 6.
(This paper was received on April 30, 1957.)

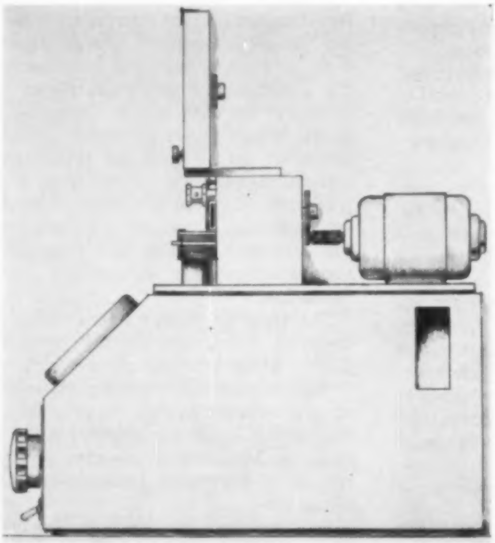


Fig. 1A. Side-view schematic of intensity-scale type 16mm sensitometer.

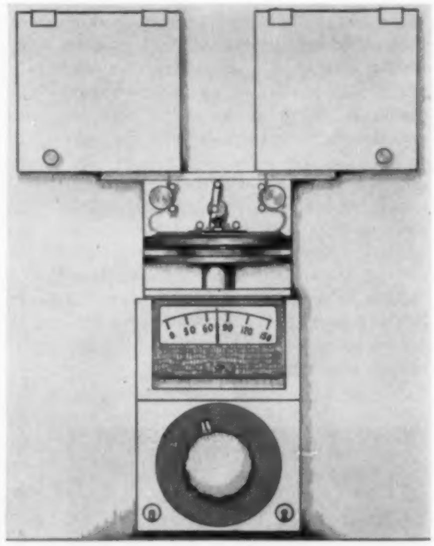


Fig. 1B. Front-view schematic of sensitometer.

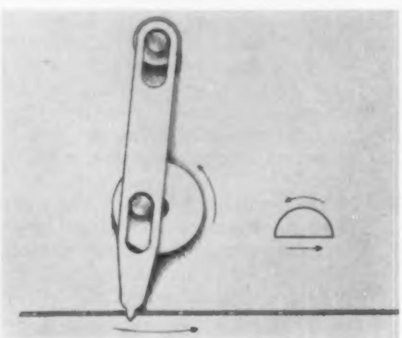


Fig. 2. Schematic of "lazy D pick" movement of the frame advance.

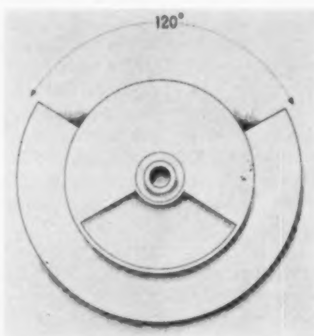


Fig. 3. Flat, disk-type shutter having a 120° opening.

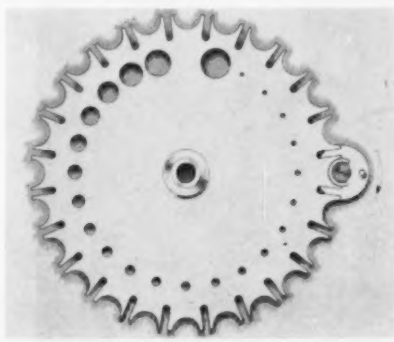


Fig. 4. Flat, aluminum-disk light modulator.

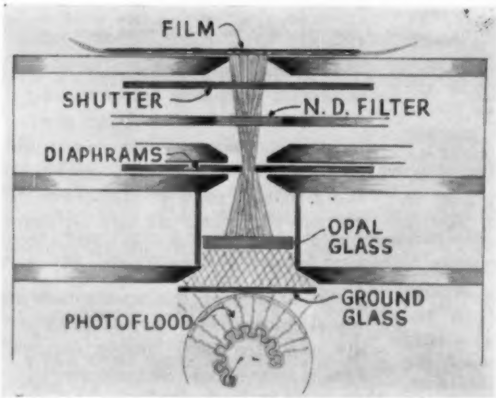


Fig. 5. Drawing of relative positions of film, shutter, filters, diaphragms, opal glass, ground glass and photoflood.

Fig. 6. The control sensitometer showing large-dial voltmeter.

$\frac{1}{16}$ in. by $\frac{1}{4}$ in. by 2 in., with two elongated slots, one located above the other lengthwise. The upper slot slides on a fixed post and the lower slot is engaged with a crank pin. The "pick" or claw that engages the film perforation has the shape of a full-fitting sprocket tooth.

This slotted bar with the claw on the lower end is under light spring tension. The position of the fixed post in the slot determines the arc that the bar swings in while engaged with the film. The lower slot in which the crankpin turns gives the forward motion for the film while in the lower 180° of its rotation. In the upper 180° it lifts the claw out of the perforation and back to the succeeding one.

The film is guided by fixed side rails on the aperture plate. In order to keep light from leaking to adjoining frames, this plate is made without any channel. A small pressure plate holds the film against the aperture. It is unnecessary to remove this pressure plate for threading the raw stock.

The mechanism is gear-coupled to an 1800-rpm synchronous motor. The gear reduction system causes it to operate at 8 frames/sec. The shutter is a flat, disk-type and rotates close to the film plane with a 120° opening (Fig. 3). This results in an exposure of 1/25 sec.

The light modulator is a flat disk of hard aluminum located $\frac{3}{4}$ in. below the shutter and film plane (Fig. 4). This disk is divided into 24 segments, 23 of which contain diaphragms. The outer rim of this disk is machined to make a 48-point star to form a Geneva movement for advancing the diaphragms in sequence. The diaphragm advance, of course, takes place while the shutter is closed and at the same interval that the raw stock is being moved to the next frame.

The diaphragms range from 0.020 in. for the smallest to 0.254 in. for the largest in size. The rate of increase in size of the holes is designed to produce 0.10 log E steps. This covers a range equivalent to $7\frac{2}{3}$ f-stops of a camera lens and appears to give adequate range for the sensitometry for which this instrument is intended.

Mounted between the diaphragms and the shutter is a filter slide with four receptacles (Fig. 5). These are fitted with neutral density filters in order to balance

Fig. 7. Close-up of film-transport mechanism; pressure plate and filter slide are removed.

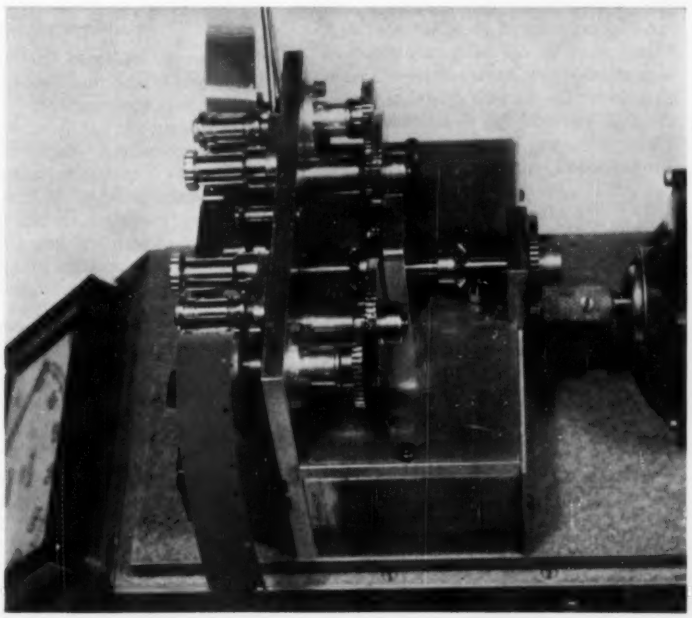


Fig. 8. Close-up showing arrangement of the gears.

various emulsion speeds to a standard setting of the light source.

Below the diaphragm plane is a piece of flashed opal glass which, when illuminated, is the light source which exposes the film. The opal glass is illuminated by a standard #1 photoflood burning at approximately 90 v. The voltage is regulated by a power-stat and adjusted by reading a large-dial voltmeter (Figs. 6 and 7).

A large blower is used to cool the lamp and the air is channeled around a labyrinth which prevents any escape of light while operating in the dark. The photoflood is used at 120 to 124 v only to expose the slowest emulsion, Eastman Color Internegative, Type 7270. We were unable to meet the specifications, for this film at normal running speed, as we should have at least four times the light to get an adequate exposure range. This could, however, be accomplished by operating the instrument at 2 frames/sec. This would still keep the exposure time under $\frac{1}{8}$ sec and would not involve the "reciprocity failure" law in practical results.

The life of the #1 photoflood at 90 v is very good. Blackening of the frosted surface does not take place for many hours and, then, not directly in the center. In testing a sleeve of six photoflood lamps read through the printing aperture with a Densichron,[2] four of the lamps gave identical readings; the other two read within 0.07 density and, of course, may be compensated for by raising the voltage approximately 1 v.

In another test, we allowed the lamp to burn continuously for $1\frac{1}{2}$ hr at 90 v with the Densichron probe in the aperture. At the end of this period both instrument needles were at precisely the same location and the machine was cool.

All of the mechanical elements are readily accessible for inspection or removal of dust or other particles that might affect the "repeatability" of the machine.

Ball bearings are used on the main driveshaft and Oil-Lite in all other bearings. The frame is constructed of $\frac{1}{4}$-in. 24 ST hard aluminum plate. All parts in the light path have been blackanodized. The gears and the film sprockets used are standard stock items (Fig. 8).

In practical operation, if only one strip is needed, it is only necessary to (a) move filter slide to the correct position for the emulsion to be exposed; (b) turn on lamp and adjust to 90 v; (c) slip a foot or more of film under the pressure plate; and (d) turn on motor switch. Within 10 sec the operation is completed.

We have used this sensitometer in actual practice since August 1956, and are using the third lamp at present. One of them was accidentally given 130 v and, of course, burned up.

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2. Densichron, a Trade-Mark of W. M. Welch Manufacturing Co., 1515 Sedgwick St., Chicago 10. (*See* C. A. Horton, "Printer control in color printing," *Jour. SMPTE*, **58**: 239–244, Mar. 1952.

Concentrated Developer Replenishers for Eastman Color Film Processing

By GEORGE E. CUMMINS, JACK A. COGAN and WILLIAM R. WELLER

By means of concentrated developer replenishers and reduced replenishment rates, substantial savings have been effected in the processing of Eastman Color films through a reduction in the quantity of tank developers overflowed to the sewer. This paper describes the methods used in deriving the concentrated replenisher formulas and the reduced replenishment rates.

When films are processed in a continuous machine, the chemical constitution of each bath must be maintained to obtain satisfactory results. The normal method employed to maintain chemically controlled solutions is continuous replenishment. When continuous replenishment techniques are used, a volume of good tank solution equal to the replenishment rate is overflowed to the sewer. It is obvious that any reduction in replenishment volumes consistent with controlled processing will reduce the volume of tank solution overflowed to the sewer and thereby reduce the cost of processing. This can be done by concentrating the replenisher.

The maximum concentration of a replenisher is determined by the solubility of the constituents and the volume required to dilute the tank solution to maintain satisfactory levels of development by-products. This paper describes concentrated developer replenishers found adequate for use in an experimental processing machine in the Eastman Kodak Co., and represents the best replenisher concentrations and flow rates, from an economic standpoint, for this particular installation.

Basic Principles of Developer Replenishment

When film is processed, halide ions are released into the developer; some of the developer constituents are used up or chemically changed, and organic development by-products are formed. During the process, carry-in from previous solutions or washes tends to dilute the developer, and carry-out tends to reduce the developer volume.

The developer can be maintained at a satisfactory level of chemical constitution and volume with proper replenishment.

It is evident, then, that a replenisher must be formulated and used at a rate that will:

1. replace chemicals used up or chemically changed in the process;
2. maintain halide ion and organic development by-products concentration at a satisfactory level;
3. overcome dilution due to carry-in;
4. replace tank solution lost by carry-out.

The volume of replenisher added to the developer system determines the volume of developer solution overflowed by displacement. Since the displaced developer solution is identical in composition to, and actually part of, the solution used in the process, it is wasteful of good developer to use a greater volume of replenisher than necessary. The minimum volume of replenisher that can be used is determined by the required concentration of the least soluble chemicals, and by the volume of tank developer solution that must be displaced to restrict the build-up of halide ions and organic development by-products to a satisfactory equilibrium level.

A replenisher that can be used in a minimum volume, consistent with satisfactory photographic results, will give the greatest economy.

The Solubility Limits of the Chemicals Used in the Replenishers

The Kodak Color Developing Agents CD-2 and CD-3, and benzyl alcohol were determined by laboratory tests to be the least soluble of all the chemicals required in the developer. Replenishers having concentrations as high as 7.4 g/l of CD-2 or CD-3 with 4.7 ml/l of benzyl alcohol in the negative developer replenisher were mixed and found to be the highest concentrations satisfactory for storage at room temperature (above 68 F).

Development By-Products

The bromide ion concentration in the developer-tank solution is critical and must be maintained within close limits. Since during the process bromide ion is released by the film, it is necessary to displace part of the tank solution with replenisher solution which has a reduced amount of bromide.

Iodide and chloride, as well as bromide ions, may be released from some films during processing.

Chloride ion has no significant photographic effect and iodide ions are released in such small amounts that little difficulty is encountered with the present film systems in continuously replenished processes.

If developer replenishers are of low chemical concentration, they must be used at high flow rates in order to maintain tank chemical levels. This limits the build-up of organic development by-products to a low equilibrium level by replacement. Conversely, concentrated replenishers added at low flow rates result in the build-up of organic development by-products to a higher equilibrium level.

Laboratory tests show no significant photographic difference, with the current Eastman Color products, between freshly mixed developers and those having as much as 3.0 g/l of organic development by-products.

The amount of dilution of the developer-tank solution due to carry-in from the previous wash and the loss of tank solution due to carry-out depend upon the efficiency of the wringers or squeegees used before and after the film passes through the developer tanks of the machine. It is desirable to reduce the carry-in and carry-out rates to as low a level as is practical since good developer-tank solution is displaced by water carried in and lost by carry-out.

Process Variation Tolerances

When a replenisher of approximately the same chemical composition as the tank solution is added at a relatively high flow rate, small differences in flow rate from time to time are of little importance. However, when a concentrated replenisher is added at a low flow rate, the replenisher must be metered into the developer system with greater accuracy. More critical mixing and chemical control techniques are also required.

Determination of Replenisher Formulas and Flow Rates

Formulas for and replenishment rates with concentrated developer replenishers were determined for the continuous processing machine used in this laboratory in the following manner:

(1) An estimate was made of the quantity of each chemical consumed by the film during development, using the normal replenisher and rate according to the equation:

$$F = R(X - Y) \qquad (1)$$

where

F = chemical consumed by the film in g/min
Y = tank concentration in g/l
X = replenisher concentration in g/l
R = replenishment rate in l/min

Presented on May 1, 1957, at the Society's Convention at Washington, D.C., by George E. Cummins, Jack A. Cogan and William R. Weller (who read the paper), Color Technology Div., Eastman Kodak Co., Kodak Park Rochester 4, N.Y.
(This paper was received on June 21, 1957.)

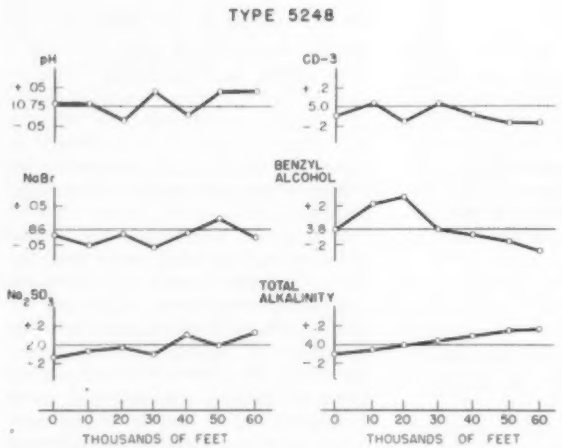

Fig. 1. Plot of chemical variability during the processing of 60,000 ft of Eastman Color Negative Film, Type 5248.

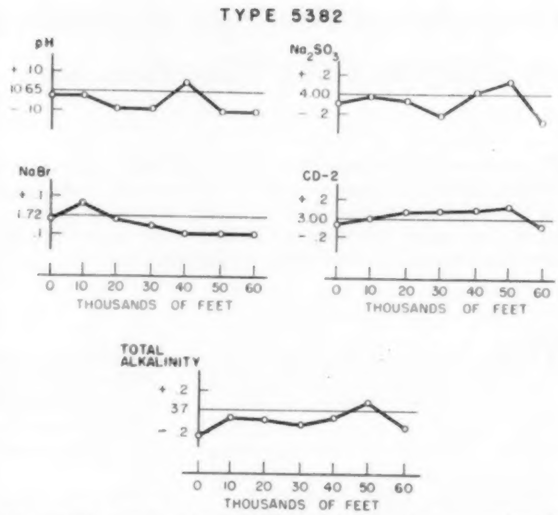

Fig. 2. Plot of chemical variability during the processing of 60,000 ft of Eastman Color Print Film, Type 5382.

In using this simplified equation, it is assumed that carry-in is relatively low and that its effect in comparison to other factors would be insignificant. Carry-out rate is not essential in this situation, as the run-out rate or rate of solution displacement is equal to the replenishment rate. Solution removed by carry-out is a part of the displaced solution and is included in the run-out rate.

This equation is valid only under conditions where the development system is in equilibrium.

Determination of the amount of CD-3 consumed by normally exposed film in the Eastman Color Negative process is shown as follows:

CD-3 in normal replenisher = 5.7 g/l
Replenisher rate with normal replenisher = 1.0 l/min
CD-3 in normal tank solution = 5.0 g/l

$$F = R(X - Y) = 1\,(5.7 - 5.0) = 0.70\ \text{g/min}$$

(2) Replenishment rates were calculated which, according to the chemical usage estimates, would provide the required amounts of the developing agents CD-2 and CD-3. The replenisher formulas were based on concentrations of CD-2 and CD-3 of 7.4 g/l since the solubility of CD-2 and CD-3 was the limiting factor in concentrating the replenishers.

Determination of the replenishment rate for the Eastman Color Negative process with CD-3 concentration of 7.4 g/l and estimated usage of 0.7 g/min is shown as follows:

Using Eq. (1), $F = R(X - Y)$

$$R = \frac{F}{X - Y} = \frac{0.70}{7.4 - 5.0} = 0.29\ \text{l/min}$$

or 290 ml/min

F = 0.70 g/min
X = 7.4 g/l CD-3 replenisher concentration

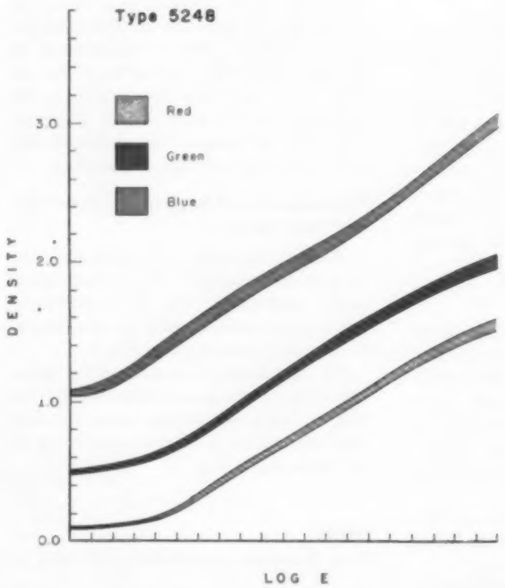

Fig. 3. Plot of sensitometric variability during the processing of 60,000 ft of Eastman Color Negative Film, Type 5248.

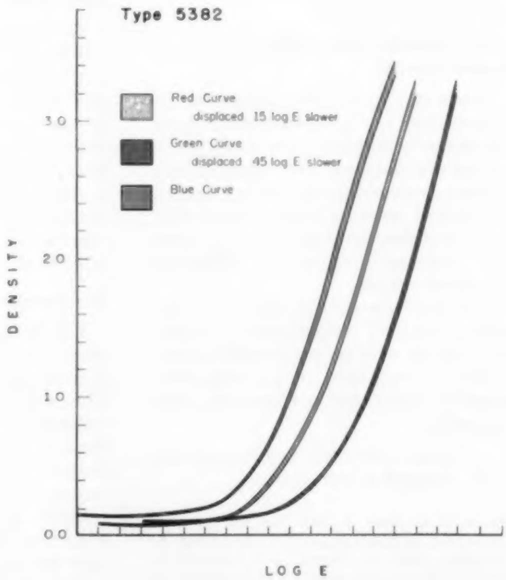

Fig. 4. Plot of sensitometric variability during the processing of 60,000 ft of Eastman Color Print Film, Type 5382

Table I. Eastman Color Negative Film, Type 5248, Developer Formulas.

Constituent	Tank	Replenisher Dilute	Replenisher Concentrated
Benzyl alcohol	3.80 g/l	3.80 g/l	4.70 g/l
Calgon	2.00	2.00	2.20
Sodium sulfite	2.00	2.30	2.70
Sodium hydroxide	0.55	0.80	1.00
Kodak Color Developing Agent, CD-3	5.00	5.70	7.30
Sodium bromide	0.86	0.86	0.25
Sodium carbonate, anhydrous	42.70	42.70	42.70
Replenishment rate	—	1.0 l/min	0.275 l/min

Table II. Eastman Color Print Film, Type 5382, Developer Formulas.

Constituent	Tank	Replenisher Dilute	Replenisher Concentrated
Calgon	2.00 g/l	2.20 g/l	2.80 g/l
Sodium sulfite	4.00	4.50	5.20
Kodak Color Developing Agent, CD-2	3.00	4.00	7.40
Sodium carbonate, anhydrous	17.10	18.80	17.10
Sodium bromide	1.72	1.72	0.95
Sodium hydroxide	—	—	1.00
Replenishment rate	—	1.0 l/min	0.200 l/min

Table III. Approximate Cost of Developer Replenisher Per 1000 Ft of Film in Machine Running 25 Ft per Min.

	Replenishment Rate		Chemical Cost Reduction
	1000 ml	275 ml	
Eastman Color Negative Film, Type 5248	$3.18	$1.11	65%
	1000 ml	200 ml	
Eastman Color Print Film, Type 5382	$1.55	$0.55	65%

Y = 5.0 g/l CD-3 tank solution concentration
R = replenishment rate in l/min

(3) The remaining chemical constituents for the preliminary concentrated replenisher formulas were calculated to correspond with CD-2 and CD-3 concentrations at 7.4 g/l and the replenishment rate at 290 ml/min in the negative process and 160 ml/min in the print process.

Eastman Color Negative and Eastman Color Print films exposed with typical pictures were processed using these concentrated replenishers and replenishment rates. The chemical composition of the tank solution was closely followed by chemical analysis.

Deviations from normal in the tank solution concentration, because the replenisher formulas and replenishment rates were not optimum, were corrected by adjusting first the replenishment rates, and then the chemical concentration of the replenishers until tank equilibrium was maintained.

Equation (2), valid for the developer system not in chemical equilibrium, was used to obtain revised chemical usage values as more extensive data were collected. These new usage values were then used in Eq. (1) to obtain revised replenisher concentrations and replenishment rates.

$$F = R\left[X + \frac{Y_2 - Y_1 e^{\frac{-tR}{v}}}{e^{\frac{-tR}{v}} - 1}\right] \qquad (2)$$

where,

F = chemical consumed by the film in g/min
R = replenishment rate (also run-off rate) in l/min
X = replenisher concentration in g/l
Y_1 = initial tank concentration in g/l
Y_2 = tank concentration at time t in g/l
t = minutes running time
v = tank volume in liters
e = base of natural logarithms = 2.71828

Tables I and II show: the machine tank formulas; the replenisher formulas used at a 1 liter/min rate; and the replenisher formulas finally determined from the calculations and processing experience established as 275 ml/min for the Eastman Color Negative system and 200 ml/min for the Eastman Color Print system.

Once replenisher formulas and replenishment rates that would satisfactorily maintain an equilibrium of chemical concentration in the tank solutions were found, they were used in the processing of 60,000 ft each of Eastman Color Negative and Eastman Color Print Film exposed with typical pictures. Data were taken from sensitometric strips processed after each 1,000 ft of film and from chemical analyses made after every 3,000 ft of film. Figures 1, 2, 3 and 4 were drawn from these data to show the maximum photographic and chemical variability during the 60,000-ft run. The chemical data indicate slight changes in tank concentrations using the calculated replenishers, and further minor adjustments might be desirable in a production operation.

These tests were made on a continuous machine which normally operates at 25 ft/min and is slower and smaller than those generally used by trade laboratories; therefore, the processing data from this machine should be used only as a guide to the replenishment effects to be expected on any other continuous Eastman Color processing machine. The formulas and rates suitable for this machine would undoubtedly have to be adjusted to obtain the desired equilibrium with a different machine. Developing agent concentrations above 7.4 g/l should be avoided since this value approaches their maximum solubility limits in the developer solution.

The use of concentrated developer replenishers in this laboratory has resulted in a substantial reduction in chemical usage. The replenishment rates have been reduced from 1,000 ml/min to 275 ml/min for Eastman Color Negative developer, and from 1,000 ml/min to 200 ml/min for Eastman Color Print developer.

Cost Data

Chemical costs were computed for the developers used in this laboratory with the previous replenishers and with the concentrated replenishers. Chemical cost data were prepared from figures published in *Chemical and Engineering News* by the American Chemical Society on December 31, 1956, and would be expected to vary somewhat throughout the country and from year to year.

The approximate costs of developer replenishers for processing 1,000 ft of Eastman Color Negative Film and Eastman Color Print Film with the normal and reduced replenishment rates are shown in Table III. These costs will no doubt vary from one installation to another depending upon the type of equipment used, carry-in and carry-out rates, replenisher concentrations and flow rates.

Annual Meeting, 1957, Amendment of Bylaws

Amendments proposed to the Society's Bylaws were published in the August *Journal*, p. 487. They will be considered and voted on during the Annual Business Meeting of the Society at the Sheraton Hotel in Philadelphia on Friday, October 4, at 2:15 P.M.

Errata

John R. Turner and Einar W. Jensen, "Some principles of spray processing," *Jour. SMPTE*, 65: 92–97, Feb. 1956.
On p. 94, second column, *for* the U.S. Patent number 2123455
read 2123445.

A Directory for Members, April 1957, Part II
On p. 28, *for* **Burris, Edward E.,** c/o Beeland-Wood Films, Inc.
read———,c/o Beeland-King Films, Inc.
On p. 60, *for* **Schlanger, Ben,** Consultant, Audio-Visual Bldg., 108 W. 37 St.
read———,Audio-Visual Building, 108 E. 37 St.
On p. 81, *add* under Ohio: Maple Hgts., **E. D. Bell.**

Ed. Note: Advice about bringing up to date the titles or positions of some members has been received since the April *Journal*. Instructions for correcting listings will be appreciated at any time — to help make a more accurate *Directory* when it is again published in April 1958.

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motion-picture standards

Reaffirmation of American Standard

PH22.74-1951, Zero Point for Focusing Scales on 16-Millimeter and 8-Millimeter Motion Picture Cameras, was reviewed by the 16mm and 8mm Committee, Standards Committee, ASA Sectional Committee PH22, and on July 19, 1957, it was reaffirmed without change by the ASA as PH22.74-1951. Copies of this standard are available at twenty-five cents each on order from the American Standards Association, Incorporated, 70 East 45 Street, New York 17.

PH22.23, 8mm Motion-Picture Projection Reels

A proposed revision of American Standard Z22.23-1941 is published here for a three-month period of trial and criticism.

Revision of this standard was first initiated in 1946. A wide diversity of opinion concerning reel dimensions was found to exist among the reel manufacturers and several subsequent attempts were made to revise this standard. Agreement on the proposal was complicated by the large number of 8mm reel manufacturers and the insistence on a slotted keyway on both flanges. Consideration of the numerous recommendations and comments submitted to the 16 & 8mm and Standards Committees was a lengthy process and this proposal is the result of many meetings, reports and revisions.

Z22.23-1941 has been completely revised to include a change in title, addition of a scope, description of dimensions, notes, appendix and the inclusion of specifications for 200, 400, 600 and 800-ft reels rather than the single 200-ft reel dimensions specified in the old standard.

All comments should be sent to J. Howard Schumacher, SMPTE Staff Engineer, prior to December 15, 1957. If no adverse comments are received, the proposal will then be submitted to ASA Sectional Committee PH22 for further processing as an American Standard.—*J.H.S.*

Proposed American Standard

8mm Motion-Picture Projection Reels

PH22.23
Rev. Z22.23-1941

1. Scope

1.1 This standard specifies the dimensions for 8mm motion-picture projection reels having film capacities of 200, 400, 600 or 800 ft.

1.2 The note is a part of the standard.

2. Dimensions

2.1 The dimensions shall be as specified in the diagram and tables.

2.2 Dimension C shall be measured between the inside faces of the two reel flanges. If spring fingers are used to engage the edges of the film, dimension C shall be measured with the fingers fully expanded.

2.3 The measurement of dimension G shall include any embossing.

2.4 Dimension H shall be measured at the core and shall include rivets, lugs and any other protrusions.

2.5 Dimension J shall apply within a circle of radius ½ in. (12.7mm) or more, centered on the spindle-hole axis.

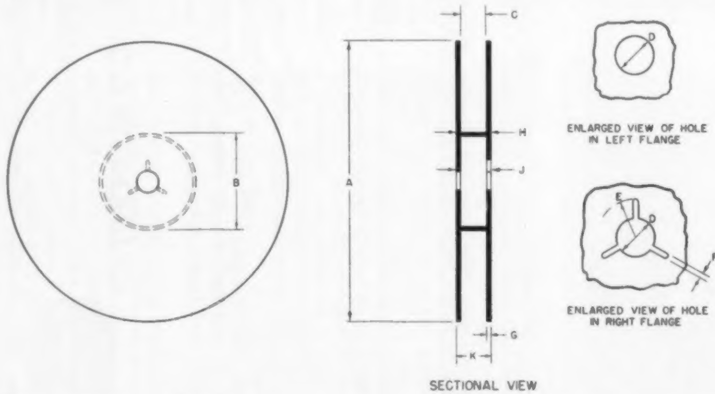
2.6 Dimension K shall be measured at the periphery of the reel.

2.7 The maximum flange and core eccentricity shall be 0.010 in. (0.25mm). The total maximum deviation may be 0.020 in. (0.51mm), measured from the spindle-hole centerline.

2.8 Lateral runout, dimension L, is the maximum departure of any point on a flange of the reel from the *intended* plane of rotation of that point, when the reel is rotated on an accurate and tightly fitted shaft. This departure can be in either direction from the plane; therefore, the total excursion can be twice the numerical value shown.

NOTE

The drive side of the reel shall have one or more keyways, but preferably an odd number. There shall be no driving keyways in the other side of the reel.



NOT APPROVED

TABLE I

Capacity of Reel		Dimension	Inches		Millimeters	
Feet	Meters		Max	Min	Max	Min
200	61	A	5.031	5.000	127.79	127.00
		B	2.000	1.500	50.80	38.10
		L	0.057		1.45	
400	122	A	7.031	7.000	178.59	177.80
		B	2.500	1.500	63.50	38.10
		L	0.080		2.03	
*600	183	A	9.031	9.000	229.39	228.60
		B	3.531	3.469	89.69	88.11
		L	0.103		2.62	
*800	244	A	10.531	10.500	267.49	266.70
		B	4.906	4.844	124.61	123.04
		L	0.120		3.05	

*See Appendix f

TABLE II

Dimension	Inches	Millimeters
C	0.350 ± 0.030	8.89 ± 0.76
D	0.319 Max	8.10 Max
	0.316 Min	8.03 Min
E	0.312 ± 0.005	7.93 ± 0.13
F	0.070 Max	1.78 Max
	0.060 Min	1.52 Min
G	0.091 Max	2.31 Max
	0.025 Min	0.64 Min
H	0.562 Max	14.28 Max
J	0.450 Max	11.43 Max
K	0.562 Max	14.28 Max

APPENDIX

a. Dimension D was chosen to give sufficient clearance between the reels and the largest spindles normally used on 8mm projectors.

b. The nominal value of C was chosen to provide proper lateral clearance for the film. The channel is narrow enough to prevent the film from wandering laterally too much as it is coiled, a condition which causes loose winding and excessively large rolls.

c. It is recommended that the driven flange have at least three driving slots so that it will not be necessary to turn the reel more than 120 degrees in order to engage it with the driving key of the spindle. An odd number of slots is suggested so that the keyway cannot come into alignment with the spring that normally latches the reel on the spindle and thus allow the reel to move along the spindle.

d. When the ratio of reel flange diameter (A) to core diameter (B) is small, there tends to be less variation in the tension to which film is subjected by the take-up mechanism throughout the projection of a roll of film. This is particularly true if a constant torque device is used. In this standard, the outside diameters of the flanges (A) were made as large as practicable commensurate with past practice in the design of projectors, reel containers, rewind units, and similar equipment. This made it possible to specify relatively large cores (which are desirable) and to attain reasonably small flange-to-core ratios.

e. For 200 and 400-ft reels, rather large tolerances are given for B in order to include reels of current manufacture which have given reasonably satisfactory service. When new reels are designed, or when present reels are re-tooled, the cores for the 200 and 400-ft reels should be made in accordance with the maximum values shown in the table. If this is done, it may be possible to have future issues of this standard show tolerances on core diameter similar to those specified for 600 and 800-ft reels.

f. 600-ft and 800-ft reels are not in use at this time. The specifications are provided so that a standard will be available should these reels come into use.

PH22.23 NOT APPROVED

Advance Program: 82d Convention — Philadelphia

THIS PROGRAM was checked for completeness and accuracy at the time it went to press, but a few variations may be expected before the opening date of the Convention. Some expected information on a few authors and papers has not yet arrived, but in general the papers and sessions will be as presented below.

There have been two general changes since the postal announcement was mailed on August 22. The session on Color TV has been moved from Tuesday afternoon to Wednesday morning and a session on Instrumentation and High-Speed Photography has been scheduled for Tuesday afternoon. The number of papers in the category of Laboratory Practice made it advisable to schedule two sessions, the first to begin Friday morning.

Detailed information such as the timing of specific papers or committee meetings will be available from SMPTE headquarters in New York (LOngacre 5-0172). It is suggested that interested persons telephone during the week before the Convention.

Besides the information for pre-registration for Convention events, the postal announcement contained a card for conveniently making hotel reservations. Reservations may be made by addressing:

Lloyd B. Carswell, General Manager
Sheraton Hotel
1725 Pennsylvania Blvd.
Philadelphia 3, Pa.

The rates for single rooms range from $8.50 to $18.00. Double rooms (two persons) are priced at $14.00 to $19.00. Registration for members is $5.00 and for nonmembers is $7.50. Ladies Registration is $5.00. As has been the practice for some time, there will be a discount for early-birds. Members who send the money for luncheon and banquet tickets with their advanced registration are entitled to a discount of $2.00 on the combined price of the luncheon ($4.00) and banquet ($15.00).

The entertainment events were described briefly in the August *Journal* (p. 492) and the "fun" part of the program has not been changed. Sunday will be given over to historical tours and theatrical and sports activities during the day and the evening will include dining and dancing in pleasant places with pleasant company. A buffet supper at wonderful Cherry Hill Inn is still on the "tentative" list, but if the plans are "finalized" a bus will leave the Sheraton Hotel at 6:00 p.m. for the convenience of the merry-makers.

After the Semiannual Cocktail party at 6:45 P.M. on Monday evening, the Banquet and Dance will follow at 8:00 P.M.

The papers sessions will be prefaced with motion-picture short subjects which have been arranged by Jack McCullough and will include outstanding subjects from Walt Disney Studios, UPA, Columbia Pictures, Warner Bros., National Film Board of Canada and the Ford Motor Co. Several of the films scheduled for showing are award winners.

Tentative Schedule of Committee Meetings

Wednesday, October 2
6:00 P.M. Current Convention Arrangements

Thursday, October 3
10:00 A.M. PH3

Friday, October 4
10:00 A.M. Film Projection Practice
2:00 P.M. Sound

Saturday, October 5
8:30 A.M. Association of Cinema Laboratories, Breakfast
9:30 A.M. Closed Circuit TV
2:00 P.M. Laboratory Practice
3:30 P.M. Section & Student Chapter Officers
4:00 P.M. Television

Monday, October 7
10:00 A.M. 83d Convention Papers
10:00 A.M. PH22
2:00 P.M. Board of Editors
3:00 P.M. Publications Advisory
2:00 P.M. Film Dimensions

Tuesday, October 8
10:00 A.M. High-Speed Photography
2:00 P.M. 16 & 8mm

Wednesday, October 9
10:00 A.M. Screen Brightness

Final schedule will be listed in the Convention Program and meeting notices will be mailed to committee members.

If your questions have not been answered here, call Society headquarters — especially if some special item is of paramount importance.

THURSDAY — OCTOBER 3

2:00 Registration opens in the Third Floor Assembly, Sheraton Hotel

FRIDAY MORNING — OCTOBER 4

9:00 Registration

10:00 LABORATORY PRACTICE I

Large-Capacity 16mm Printer Loop Trees
RUSSELL N. JENKINS, VICTOR E. PATTERSON and GARLAND C. MISENER, *Capital Film Laboratories, Washington, D.C.*

Improvements in Variable-Density Recording
JOHN A. MAURER, *JM Developments, Inc., New York*
A mirror galvanometer with a suitable optical system gives a recording line of light of constant dimensions and variable intensity. By the use of a suitably designed mask, the variation of intensity with the applied electrical signal can be made nonlinear in any desired way. This nonlinearity can be adjusted to suit the characteristics of any film and method of processing so as to produce a soundtrack in which the relation of light transmission to the original electrical signal is linear over very nearly the entire range of transmission that can be obtained with the type of film and processing in question. The cases of practical interest are recording on "positive" type films for direct playback, normal negative-positive sound recording and printing, recording on reversal stocks for direct playback, and recording predistorted "direct positive" originals which yield linear prints when printed on reversal stocks. In all of these cases the method yields prints having reproduction levels 6 to 8 db higher than have been obtained by previous variable-density recording techniques, with low distortion, and with exceptionally good high-frequency response when the method is employed for "electrical printing" on either black-and-white or color stocks. A special printer which uses this technique to produce prints carrying optical soundtracks from original newsreel films carrying sound recorded on magnetic stripes is described and illustrated.

Use of a Motion-Picture Printer as a Sensitometer
ROBERT O. GALE and JOHN J. GRAHAM, *Eastman Kodak Co., Rochester, N.Y.*
A Bell & Howell Printer, Model D, can be used as a sensitometer for exposing process control strips in small laboratories or for emergency work. The variability in exposure of a printer was only slightly greater than that of a commercially used sensitometer, when the instruments were compared under carefully controlled conditions. The procedure includes the selection and storage of check film stock, printer control, monitoring and control of illumination, and making controlled exposures.

An Electromechanical Light Valve For Motion Picture Printers
FRANK HERRNFELD, *Frank Herrnfeld Engineering Corp., Culver City, Calif.*
This paper describes a light valve which is actuated from a control tape without use of intervening relays. The average change in intensity will take 10 msec, or less than one sprocket hole, when printer is running at 90 ft/min. The total maximum change obtainable is three stops, which may be divided into 32 or 64 equal logarithmic increments. Flatness of field is that of a projection-type system. Light intensity is limited only by the size of lamp used.

A New High-Speed 16mm Reversal Color Camera Film
HAROLD JONES, *Ansco, Binghamton, N.Y.*

12:00 Get-Together Luncheon

Speaker: Theodore A. Smith. Executive Vice-President, Industrial Electronic Products, Radio Corp. of America

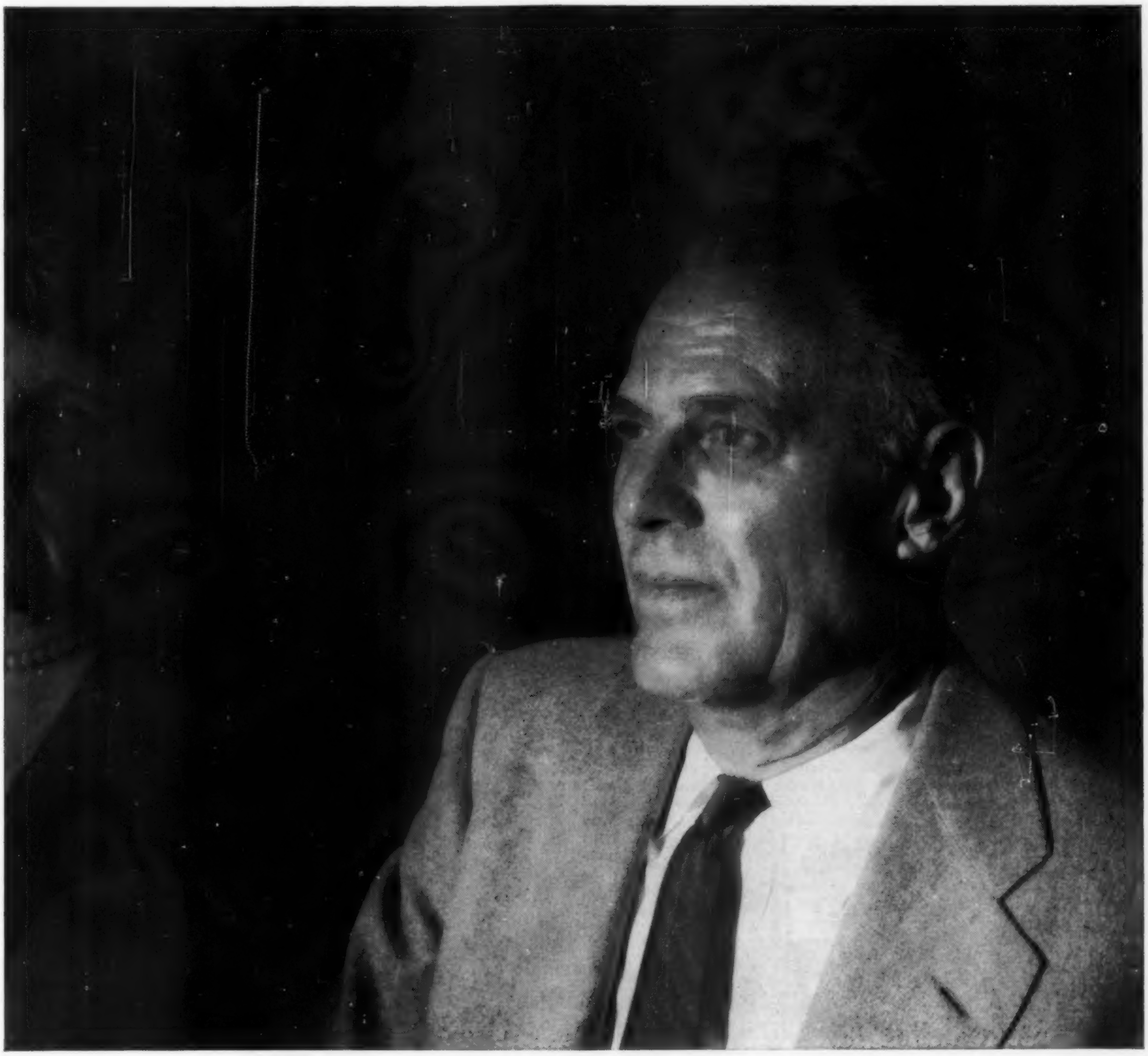
FRIDAY AFTERNOON

2:15 ANNUAL BUSINESS MEETING—Admendment of Bylaws

2:30 LABORATORY PRACTICE II

Superimposed Titles on Color Films by a Photo-Resist Method
W. I. KISNER and J. J. MURRAY, *Eastman Kodak Co., Rochester, N.Y.*
A method for adding titles to conventional image-bearing color photographic materials is described. The procedure involves preparation of a black-and-white title positive, coating of the color film with a photo-resist material, exposure and development of the resist, selective removal of the title images by the action of destructive solutions and, finally, removal of the resist. The method has been successfully used with Kodachrome, Ektachrome and Eastman Color Print Films. Applications include titles for motion-picture release prints, slidefilms and individual transparencies.

Glass Filters for Color Printing
RICHARD L. WHITE and ROBERT C. LOVICK, *Eastman Kodak Co., Rochester, N.Y.*
Narrow-band filters are used to print Eastman Color Negative Film, Type 5248, onto Eastman Panchromatic Separation Film, Type 5235, and for printing these separations onto Eastman Color Internegative Film, Type 5245. Such filters are also used in additive printers for making prints onto Eastman Color Print Film, Type 5382. The gelatin filters used for this purpose can be re-



placed with glass filters with a great increase in stability and a gain in exposure. All the glass filters recommended are standard stock Corning glass filters with one exception. A unique red-absorbing filter, used in the green filter combination, has been made on special order by the Corning Glass Works and will be supplied by the Eastman Kodak Co.

An Automatic Printer Light Selector for the Bell & Howell Models D and J Printers
L. WARGO, H. M. LITTLE and H. L. BAUMBACH, *Unicorn Engineering Corp., Hollywood*
A device has been designed to bring about the automatic setting of the printer light selection lever on the Bell & Howell Models D and J Printers. Punched paper tape containing the printer light sequence is prepared on a keyboard-perforator and this tape fed into a tape reader. The electrical signals produced in the reader are then decoded by a computer unit which in turn directs a servo unit in its manipulation of the printer lever. The action of the device is considerably more rapid and accurate than manual performance and, of course, it can operate in total darkness. The robot unit is very easily installed on the printing machine and it demands no mechanical alteration of the printing equipment.

A New Color Timer for Motion-Picture Films
J. W. STAFFORD and H. L. BAUMBACH, *Unicorn Engineering Corp., Hollywood*
A new device has been developed for the determination of the correct printing exposures for color films. The device accepts a density range test as exposed under the negative scene with average standard exposure conditions. The viewing field under the test positive may be varied in hue to the desired color balance while a condition of constant brightness is automatically maintained. A built-in analog computer calculates the corrections from the standard condition in terms of red, green, and blue light for additive printing; and of cyan, magenta, and yellow light for subtractive printing. The variable hue viewing field is surrounded by standard photometric fields to maintain constant eye adaptation. The system enables the color timer to specify correct printing conditions directly from the single test series. In most cases, a fully corrected print is produced directly from the color timing.

A New Automatic Light Control for Additive Color Printing
HANS-CHRISTOPH WOHLRAB, *Bell & Howell Co., Chicago.*
Splitting up a white light beam into the three fundamental colors, red, green and blue, is done by dichroic mirrors. The individual lights are controlled by vanes and then reunited in the printing aperture. The vane setting is controlled by a five-hole code on a commercial control tape. The color informations are fed into a memory system and released by a patch or notch cue to the vanes. Besides this the tape controls the fader as well as the automatic start and stop of the printer. The paper explains the reasons for the adopted solution of the different problems, shows the technical data and describes an application of the light control on an additive color printer.

An Instantaneous Electronic Color Negative Film Analyzer
C. J. HIRSCH, *Hazeltine Research Corp., Little Neck, N.Y.*
This paper describes an analyzer for color negative film which displays instantaneously a positive color picture on a color TV tube when a color negative is inserted in the device. Color balance and density are adjusted by calibrated controls whose settings are used by a printer to produce a positive closely approximating the displayed picture. The device uses TV techniques to simulate additively the subtractive properties of positive film in spectral taking sensitivities, gamma, contrast, and unwanted dye absorptions.

FRIDAY EVENING

8:00 Awards Presentations

Dr. Filmore Park, National Research Council of Canada, will present an illustrated lecture on "Photography and the IGY."

SATURDAY MORNING — OCTOBER 5

9:00 GENERAL MOTION-PICTURE

The Optics of the Lenticular Color-Film Process
R. KINGSLAKE, *Eastman Kodak Co., Rochester, N.Y.*
In spite of the fact that the lenticular color-film process has been known for fifty years, very little commercial use has been made of it largely because of the lack of suitable lenses. The requirements of the various optical components used in cameras, printers and projectors are discussed, and it is shown that every optical requirement can be met. However, this will often require specially designed lenses, which are likely to be unusually large and consequently expensive.

The Projection Optical Assembly Considered as an Integral System
HAROLD E. ROSENBERGER, *Bausch & Lomb Optical Co., Rochester, N.Y.*
The function of each of the optical components of the projection assembly and the interrelationship between these components are discussed. The true f-number of the system is contrasted with the f-number of the projection lens, considering the effects of going to higher speed systems. The components of an up-to-date optical projection system including the new multilayer light-reflecting, heat-transmitting reflectors are described.

Can Xenon Arc Lamps Replace Carbon Arc Lamps?
WARREN B. REESE (*Prepared Jointly by Macbeth Corp., Newburgh, N.Y., and OSRAM, Munich, Germany*)
Xenon arc lamps have inherent properties as to spectral energy characteristics, luminous efficiency, electrical operating characteristics, and geometrical characteristics which make them attractive, from both a technical and an economical point of view, as the first new light source which is feasible as a replacement for the traditionally used carbon arc lamps in motion-picture film projectors. Technical data on xenon lamp operating characteristics, projector optical design, and screen brightness measurements will be discussed fully. Practical experience as a result of xenon lamps already being used in film projectors will also be covered.

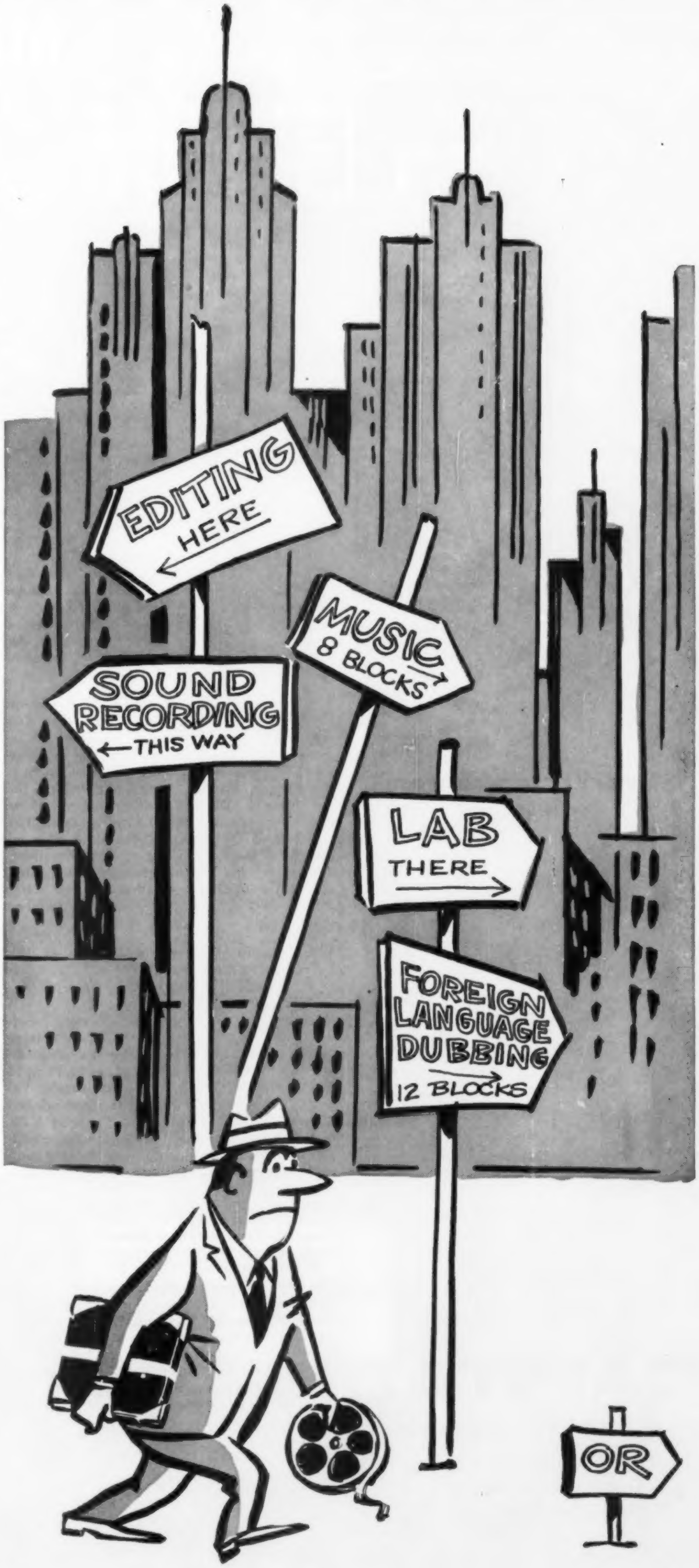
Acoustic Considerations in The National Film Board of Canada Studios
R. W. CURTIS, *National Film Board, Montreal.*
Special building techniques have permitted the attainment of a high degree of sound isolation in the Montreal studios of Canada's National Film Board. A description is given of these techniques and of the methods whereby the various theaters and recording studios were given suitable acoustic characteristics. The apparatus and procedures used in the acoustic measurements will be described.

Photographic Duplicating of Variable-Area Sound Recordings
J. F. FINKLE, *Eastman Kodak Co., Rochester, N.Y.*
A sound recording quality comparison is made between prints made directly from original variable-area negatives and prints made from photographic duplicate negatives. The relationship of the densities of the master positive and dupe negative to cross-modulation distortion, signal-to-noise ratio, and frequency response of the final print is discussed.

Progress Report on Infrared Transparency of Magnetic Tracks
GEORGE LEWIN, *Army Pictorial Center, Long Island City, N.Y.*
A report on further tests of the infrared transparency effect, including some preliminary work on 35mm reproducers and additional 16mm demonstration material. The first report appears in this issue of the *Journal*.

Use of Multitrack Recorders for Simultaneous Mastering of Single-Channel and Stereo Releases
C. ROBERT PAULSON, *Ampex Corp., Redwood City, Calif.*
The single-channel magnetic recorder as a mastering device is giving way to the multitrack recorder for reasons of greater flexibility and economy in the mastering session. Specially designed equipment with as many as eight separated channels is currently in use. Various erase, recording and playback head configurations, and specialized control and inter-record circuits give improved flexibility both in mastering and rerecording. Operational and technical features of such apparatus are described and demonstrated.

Averaging Screen-Illumination Readings
ARMIN J. HILL, *Motion Picture Research Council, Hollywood*
In obtaining the total output of a projector, or the total illumination which falls on a projection screen, it is customary to read the incident intensity at selected points in the illuminated area. These readings are then averaged by a suitable weighting formula to give the average over the face of the screen. This paper discusses some of the more commonly used formulae, considers their relative accuracy and the effects of various screen aspect ratios on the results obtained with them. It also analyzes various types of errors on the basis of an idealized distribution pattern which experience has shown checks closely with practical results.



SATURDAY AFTERNOON

2:00 CLOSED CIRCUIT TV AND VIDEO TAPE RECORDING

Economic Consideration in Closed-Circuit TV Design
DONALD KIRK, JR., *Jerrold Electronics Corp., Philadelphia*
During the last five years a number of systems for distribution of entertainment-type TV programming via wire to homes of paying subscribers have been successfully installed and operated. This paper considers the economic factors which have led to the systems currently being installed. Areas of greatest possible improvement are outlined. Systems designed to take care of different billing procedures are discussed. Some guesses are made as to what may evolve in the system of the future.

Television in Washington County Schools
JOHN R. BRUGGER, *Board of Education, Hagerstown, Md.*
Teaching by television has been tested in the elementary and high schools of Washington County, Md. The effectiveness of this method is evaluated and the problems encountered, particularly with respect to equipment and facilities, are described.

Visual Amplification
H. J. SCHLAFLY, *Teleprompter Corp., New York*
"Visual amplification" is a specialized application of closed-circuit TV. It is to the sense of sight what studio amplification is to the sense of hearing. This technique, described here in detail, permits the pickup and magnified display of visual details.

The Ampex Videotape Recorder: An Evolution
CHARLES P. GINSBURG, *Ampex Corp., Redwood City, Calif.*
The Ampex Videotape Recorder came as a considerable surprise to the TV industry, when it was demonstrated in April 1956. Behind the machine was a long development project whose story has never previously been told. The approaches which failed, the unexpected solutions which turned up while searching for others, the experiments that succeeded, and the interplay of technical contributions by the staff's creative personalities are described by the head of the project.

Videotape in 1958 — A Discussion of the Production Ampex VTR
ROSS H. SNYDER, *Ampex Corp., Redwood City, Calif.*
During the past year eleven laboratory hand-built Videotape Recorders performed a large part of the local clock time-delay TV programming for the three largest U.S. networks. Planned as intensive field testing, this use dictated extensive revisions and refinements of the original design. Interchangeability of tapes from VTR to VTR, improved dubbing facilities, tape editing, sync source separation, and improved component accessibility are all, in part, contributions by industry users. This paper discusses problems encountered and solved in TV's first VTR year.

Magnetic Tape for Video Recording
R. A. von BEHREN, *Minnesota Mining & Mfg. Co., St. Paul, Minn.*
The new video tape recording systems now in commercial and experimental use require special magnetic tapes differing in design from standard types, and manufactured to a standard of perfection which a short time ago was believed impossible to achieve. This paper discusses some of the unique features of video recording tapes and the problems encountered in their development.

MONDAY MORNING — OCTOBER 7

9:30 MILITARY USES OF TV I

Pickup Tube Performance With Slow Scanning Rates
CHARLES T. SHELTON, *Radio Corp. of America, Camden, N.J.*
For military purposes it is often desirable to operate a TV system at nonstandard scanning rates. This paper reports the result of a Signal Corps sponsored study of the operation of standard image orthicons and vidicons at reduced rates. The resolution, sensitivity and other characteristics of these tubes have been measured and thought has been given to characteristics desired for tubes designed particularly for slow-scan operation.

Control Information by Television — Inaugural Parade 1957
Lt.-Col. HOLLIS DAKIN, *Army Pictorial Center, Long Island City, N.Y.*
This paper is devoted to a detailed explanation of the closed-circuit TV system used by the Army for control of movement of the Inauguration Day Parade, 1957. Control information was available for the immediate use of the parade marshals through complete coverage of the parade route by vidicon (TTV-6 and Tele-Scout) and image-orthicon equipment.

Staff Information by Television — Operation King Cole, 1957
Lt.-Col. HOLLIS DAKIN, *Army Pictorial Center, Long Island City, N.Y.*
This paper explains how the Army used closed-circuit TV to disseminate timely information simultaneously to a Field Army Staff during "Operation King Cole" at Fort Polk. This was the first large-scale attempt by the military to provide necessary staff information via closed-circuit TV.

Airborne Closed-Loop TV System
ARTHUR F. FLACCO, *Radio Corp. of America, Camden, N.J.*
This paper describes a militarized airborne TV system which uses wide-spaced image orthicons (Type 6849) and nonstandard line and field rates. The need for remotely located cameras of reduced size presented deflection circuitry problems. Temperature extremes and vibration and shock effects had to be overcome without exception for any component in the system. The complete system consists of two cameras, a synchronizer, a monitor, a power supply, and an auxiliary field rate unit.

Some Aspects of the Application of TV to the Tracking of Guided Missiles
HOWARD L. ROBERTS, *Denver Research Inst., Univ. of Denver, Denver, Colo.*
An investigation to determine whether television could increase the range of optical tracking devices has been conducted for the U.S. Navy Air Missile Test Center, Point Mugu, Calif., by the Denver Research Institute. Range is limited by loss of object contrast. An expression is developed which indicates that electrooptical devices could detect lower contrasts than can the human eye. The parameters of a TV system for aerial tracking are discussed. Both greater and lesser ranges were obtained in experiments. Other means by which TV performance might be improved are discussed.

TV Viewing of Rocket Engine Test Cells
JAY P. MITCHELL, *Diamond Power Specialty Corp., Lancaster, Ohio*
A remotely operated closed-circuit TV system especially engineered for viewing rocket engines under test conditions is discussed. The TV camera incorporates a zoom lens system, pan and tilt pedestal, and a weatherproof and soundproof camera housing. All camera functions, electrical, optical, and mechanical, are completely controlled from a master control console. The problem of acoustic shielding against noise at levels around 200 db is described.

MONDAY AFTERNOON

2:00 MILITARY USES OF TV II

The Development of the Navy Transparent Cathode-Ray Tube

Part I
Cdr. G. W. HOOVER, USN, *Office of Naval Research, Washington, D.C.*
Part II
ROSS AIKEN, *Kaiser Aircraft and Electronics*
Part III
Dr. CHARLES FELDMAN, *Naval Research Laboratory, Washington, D.C.*

Part I concerns the establishment of the requirements and the need for the development of a transparent cathode-ray tube to be used in aircraft for data display. It points out the necessity for a transparent medium to be located in the area of the windshield in order to eliminate the necessity for transition from instrument flight to contact flight and vice versa.

Part II covers the technical aspects of the tube, including a description of the circuitry.

Part III discusses the development and utilization of a transparent phosphor to be used in the flat plate cathode-ray tube. The discussion includes slides explaining the development of the phosphor with actual demonstration of the transparent phosphor.

Television for Use Under Rugged Environmental Conditions
JOHN P. DAY and FRANK R. PIKE, *Kintel, a Div. of Cohu Electronics Co., San Diego, Calif.*

A variety of applications that have been made of TV equipment under extreme environments is reviewed. The generally desirable characteristics of these equipments are examined, and the sources of present-day difficulties are discussed. The design features of a system built for rugged usage are detailed.

Army Television Research and Development
WILLIAM A. HUBER, *U.S. Army Signal Engineering Laboratories, Ft. Monmouth, N.J.*, and RICHARD B. LeVINO, *Smith-Corona, Inc.*

Military TV application requires equipment with technical and operational characteristics that differ from those found in industry. To produce such equipment the U.S. Army Signal Engineering Laboratories conducts a comprehensive research and development program that embraces all phases of the art. A technical survey of this activity is given indicating those technological limitations that now exist and are seriously impeding the military applications of television together with the developed or proposed methods of solution.

Advances in TV Performance to Satisfy Military Requirements
C. L. ELLIS, *General Electric Co., Syracuse, N.Y.*

Many military uses of television require one or more performance characteristics which are far beyond those of conventional entertainment and closed-circuit television. These characteristics include extremely high resolution, color, high sensitivity, and stereoscopic viewing. These requirements and how they were met for particular applications are discussed in detail. These applications include surveillance, remote handling of hazardous materials, missile observance, and data reporting.

MONDAY EVENING

6:45 COCKTAIL PARTY

8:00 BANQUET AND DANCE

TUESDAY MORNING — OCTOBER 8

9:00 LARGE-SCREEN TV

Survey of Large-Screen TV Projection Equipment
FRANK N. GILLETTE, *General Precision Laboratory, Pleasantville, N.Y.*

The large-screen equipment available to the industry in the period around 1950 was described to the Society in a number of different papers. Since that period certain changes have taken place in the equipment, but these changes have passed generally unnoticed because of the relatively dormant state of the closed-circuit field. A survey of the equipment now used in this very active field is presented.

A High-Brightness TV Projection System
G. W. ELLIS and C. L. ELLIS, *General Electric Co., Syracuse, N.Y.*

Of all the types of TV projection systems used today, the Eidophor is unique. Being of the "light-valve" type, it is capable of brightness comparable to film projectors. The principles of operation are reviewed with a description of the methods used to achieve almost completely automatic operation. Some interesting applications are discussed.

Television — Group Viewing
H. J. SCHLAFLY, *Teleprompter Corp., New York*

The presentation benefits of group viewing of a single visual display screen as compared to localized viewing of multiple screens are discussed. Technical considerations of large-screen TV projection viewing, including audience size and location, screen size and type, screen brightness, equipment location, and other room and viewing factors are discussed.

Medium-Sized Screen Color TV Projection
S. L. BENDELL and W. J. NEELY, *Radio Corp. of America, Camden, N.J.*

Closed circuit television has created a need for picture display equipment suitable for large groups. Basic engineering and economic factors influencing the design and use of such equipment are discussed. The wide variety of applications for such a unit dictates that special emphasis be put on compactness, mobility and easy operation.

These requirements have resulted in the design of a small inexpensive TV projector suitable for color or monochrome. Its operational features are described.

The Advantages of Using a Controlled Projection Screen With Projection Television
W. T. SNYDER and E. S. JOHNSON, *Universal Screen Co., Clinton, Mass.*
This paper discusses brilliance comparisons and methods of obtaining brilliance results. Comparisons are made using the matte-surface magnesium-carbonate block as the criterion. Brilliance ratings and their ratio to horizontal and vertical controls are discussed. The paper also covers light output of projection TV units and its ratio to screen brilliance and considers light resistance, color rendition, tone graduation and resolving power of lenticular screen material.

Automatic Announcing Techniques for TV Stations
W. H. HARTMAN and R. A. ISBERG, *Ampex Corp., Redwood City, Calif.*
Magnetic tape recordings of local announcements for use with film and network programs can be easily prepared at the convenience of the announcing staff. The equipment used for this purpose at KCRA-TV, Sacramento, Calif., makes it possible to record most of the local announcements for an 18-hour operating day in less than an hour's time. Sub-audible control tones, recorded after each announcement, automatically stop the tape transport. The technician on duty does not need to refer to the announcement continuity once he has started to play an announcement on the air. This technique can also be used with additional control tones to operate projection equipment, thereby eliminating errors on the part of operators when they are required to switch large numbers of slides during an announcement.

Automatic Cuing of TV Film Projectors
B. F. MELCHIONNI, *Radio Corp. of America, Camden, N.J.*
With the advent of automation in TV stations, it has become apparent that methods must be developed to cue the film automatically at the start of each film sequence. This paper describes methods for automatically stopping a projector with a predetermined frame in the gate by adding suitable cuing information to the film and associated reading and control mechanisms to the projector.

TUESDAY AFTERNOON

2:00 INSTRUMENTATION AND HIGH-SPEED PHOTOGRAPHY SESSION I

Mobility in Underwater Cinematography
DIMITRI REBIKOFF and PAUL CHERNEY, *Submarine Research Institute, France*
The need exists for a mechanical device, easily controlled by one man from without or within, which can move as a fish or a swimming diver, unhampered by the limitations of pressure, cold and exhaustion experienced by the diver. The conventional submersible, even when equipped with an atomic power plant, is impractical because of relative fragility, hi h cost in money and manpower, monstrous size, limited depth and poor maneuverability. The prototypes of the miniature submarine, Pegasus, represent a great step forward toward the solution of underwater photographic problems.

Characteristics of Aquar Correction Lenses
A. IVANOFF, *Submarine Research Institute, France*, and PAUL CHERNEY, *Cinefot International Corp., New York*
It is possible to overcome in some degree the loss of field of view in submarine photography by using wide-angle lenses. Using this method, submarine photography, which demands the largest possible field of view, compares unfavorably with normal photography on land. The aberrations produced by the flat window reduce the quality of the image. The chromatic aberration introduced by a flat window is perceptible at distances greater than 5 mm from the center of the film. Astigmatism is noticeable for distances less than 2 m using $f/4$, and for distances less than 5 m using $f/2$, and, finally, distortion is noticeable when the field of view is greater than 60°. It is desirable, therefore, to replace the plane window by an optical system which does not introduce aberrations and which permits the taking of submarine photographs with the full field of view of a wide-angle lens.

Explosive Studies With an Ultra-High-Speed Reimaging Camera
M. SULTANOFF, *Terminal Ballistics Laboratory, Aberdeen Proving Ground, Md.*
The optical and mechanical features incorporated in the design of a commercially available 25-frame ultra-high-speed "reimaging camera" are described. Techniques for the application of this camera to the study of several explosive events are presented. A motion picture, prepared for cine-playback of the 25 individual frames at time magnifications of approximately 200,000:10 (at standard 16-frames/sec projection speed) which greatly extend the qualitative data available from the individual photographic exposures will be shown as part of this paper.

A New 35mm High-Speed Motion-Picture Camera
ROBERT D. SHOBERG and ROBERT J. MARSHALL, *Sherman Fairchild & Associates, Inc., Yonkers, N.Y.*
From a users point of view, three points are extremely important when considering the functions of a high-speed motion-picture camera.

the first is picture quality; second, the relationship of one picture to the next in time and in position (what kind of a speed characteristic curve does it have and how steady is its film when projected); and third, action-stopping ability (shutter speed). A rotating prism coupled with a rotary disc shutter, an electronic thyratron speed control and the proper arrangement of an assortment of mechanical and optical parts contribute to reaching the optimum condition in these three points.

A New Approach to Aircraft and Missile Tracking by Use of a Negative Color Film
JOHN NIEMEYER, *Eastman Kodak Co., Rochester, N.Y.*

International High-Speed Photography Congresses: 1958 in Germany and 1960 in Washington, D.C.
RICHARD O. PAINTER, *General Motors Proving Ground, Milford, Mich.*

High-Speed Motion Picture of the Defensive Mechanism of Reptiles
HENRY M. LESTER, *Photographic Consultant, New York*

TUESDAY EVENING

8:00 INDUSTRY MILESTONES I BILINGUAL FILMS AND INTERNATIONAL TV

Tykociner's Sound Picture Contributions
JOHN B. McCULLOUGH, *Chairman, Historical and Museum Committee*

Professor Joseph T. Tykociner, now 90 years old, in 1922 demonstrated his system of recording sound optically by means of a variable-density soundtrack with a single-system camera as a result of many years of experimentation. During that year, he made one of the earliest public demonstrations of talking motion pictures. Professor Tykociner's other contributions to the field of electronics will also be described. The paper will be followed by a showing of his first film and attempted reproduction of its recorded sound. Acknowledgment is made to Edward W. Kellogg, Glenn E. Matthews, Joseph E. Aiken and Arthur Wildhagen for their counsel in preparing this milestone tribute to one of our early motion-picture pioneers.

The United States Information Agency International Television Film Network
FREDERICK A. LONG, *Television Manager, Television Unit of the United States Information Agency*

An analysis is presented of the progress being made in various countries toward worldwide use of television. The United States is presently supplying television film in 18 different languages on a scheduled broadcast basis. The essential facilities and problems of maintaining such a program are described in detail.

The Problems of International Television Broadcasting
K. R. STURLEY, *Head of Engineer Training Dept., British Broadcasting Corp., London, England*

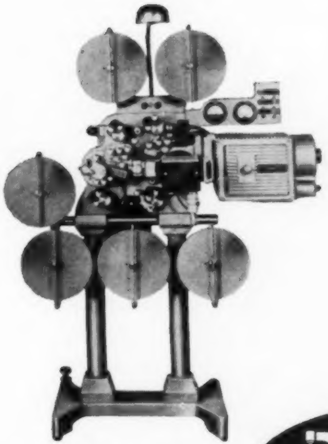
Described are the general problems arising from European International Television Program Interchange, and the current solutions for the problems of noncompatible line structure and frame rate, relay time coordination, language translating, etc. The Eurovision Network has been in operation for some time and the experiences acquired through its operation will be of great value when television is expanded to worldwide status.

The Narcom (North Atlantic Relay Communication System) Plan for Trans-Atlantic Television
WILLIAM S. HALSTEAD, *Unitel, Inc., New York*

Described in detail is the plan which was submitted to the European Broadcasting Union for linking the United States and Canada to Great Britain and Europe. The plan has been some time in the development stage and the subject extensively developed.

The Technique of Matched Time Phonetic Language Translation as Applied to Bilingual Film
MAX G. KOSARIN, *Chief, Foreign Adaptation Branch, Army Pictorial Center, Long Island City, N.Y.*

The problems and methods of language translations, wherein identical lip movement, word matching is achieved, are described. Examples are given of such translation on dual language sound film utilizing the transparent magnetic track technique developed by George Lewin.



PETERSON CONTINOUS DOUBLE-HEAD CONTACT PRINTER
MODEL 16-C-60-16MM
MODEL 35-C-60-35MM

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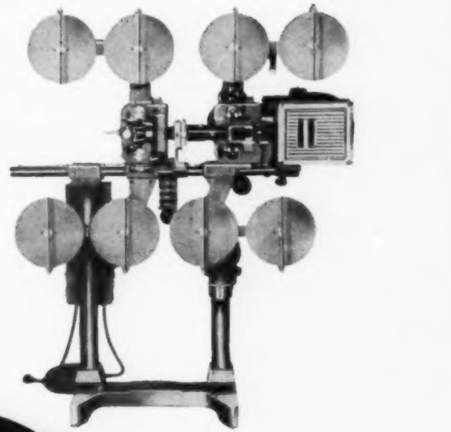
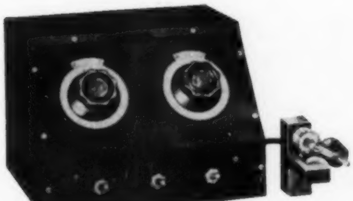
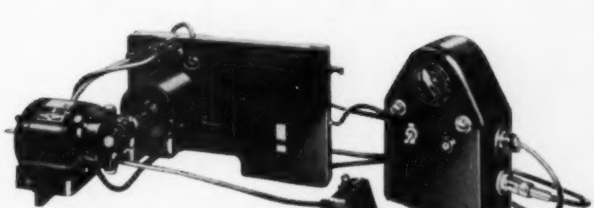


PETERSON OPTICAL PRINTER MODEL 300

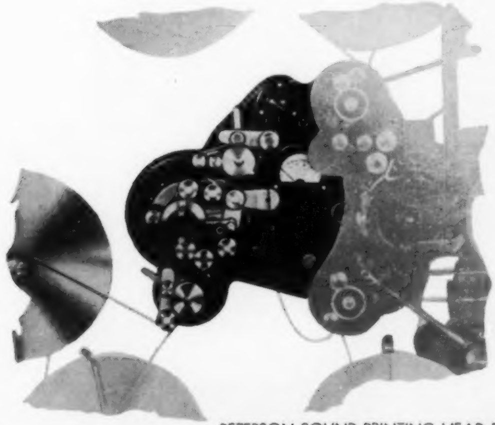
Precision Motion Picture Printing Equipment and Accessories

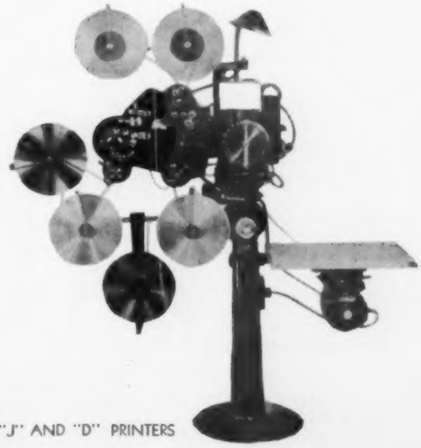


PETERSON ELECTRONIC CUEING SYSTEM FOR ALL PRINTERS



PETERSON AUTOMATIC FADE FOR MODEL "J" AND "D" PRINTERS





PETERSON SOUND PRINTING HEAD FOR MODEL "J" AND "D" PRINTERS

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A Case History of Bilingual Telecasting in Canada
ANDRE QOUIMET, *Director of TV, Province of Quebec, Canadian Broadcasting Corp.*
This paper will discuss the methods of operation and special problems of TV broadcasting to French- and English-speaking audiences in Canada.

Future Trends in Multi-Voice Films for International Television
LEON SHELLY, *Shelly Films Ltd., Toronto, Ont., Canada*
The world availability of magnetic sound equipped projectors in TV stations opens up new markets for internationally minded producers. The tools are presently available for producing bilingual films for this market. This paper describes these tools and the preplanning necessary to make such films most effective.

WEDNESDAY MORNING — OCTOBER 9

9:00 COLOR TV

Paris Symposium on Physical Problems of Color Television, 1957
R. E. GRAHAM, *Bell Telephone Laboratories, Murray Hill, N.J.*
This is a review of some aspects of this UNESCO-sponsored symposium which may be of particular interest to the Society.

Performance Objectives for Color Picture Tubes
JOHN B. CHATTEN, *Philco Corp., Philadelphia*
The luminance-chrominance principle of the NTSC color signal is based on fundamental properties of human vision and hence has important implications in the design of color TV display devices. This paper compares the color-signal processing and electron optical techniques applicable to the three-gun shadow-mask tube and the single-gun beam-index tube, with particular reference to following performance objectives: resolution and picture structure, registration and color fringing, color purity, maximum attainable luminance and saturation, gradation of luminance, gradation of saturation, contrast, and accuracy of hue reproduction. Circuit and tube requirements to optimize these aspects of performance are described and related to current design practice in the two types of color display.

The RCA TM-21 — A Stabilized Color Monitor
E. E. GLOYSTEIN and N. P. KELLAWAY, *Radio Corp. of America, Camden, N.J.*
A new color monitor has been designed to serve both as a high-quality picture display device and as an instrument for judging the quality of color TV signals. It incorporates several significant design innovations, both electrical and mechanical. The highly stabilized circuits provide a picture of excellent quality. The control panel has been designed for simplicity of operation, and the mechanical design provides good accessibility for maintenance. The monitor is designed as a major tool for use in color TV plants.

A Method for Controlling the Gray-Scale Equivalent of Colors Used in Live and Film TV Scenic and Graphic Art
WILLIAM J. WAGNER, *KRON-TV, San Francisco*
This paper describes a solution for some of the major problems encountered by artists working in color television. A color palette, known as the ChromaCHron, has been developed at KRON-TV. The palette reduces the number of paints needed to produce color artwork and catalogues the basic colors, intermixtures of these colors, and desaturation of all these colors. Ninety-one color mixtures are produced from five chromatic and two achromatic paints. Each of these colors is given a number which corresponds to a gray scale of twenty values. It guides the artist as to how his colors will reproduce in black-and-white. The most reflective color adjacent to the most light absorbing color in the ChromaCHron palette will not exceed the color system's 20 to 1 light ratio limitations. Color transparencies have been made of these pigments to obtain the TV gray-scale equivalents through a photographic process.

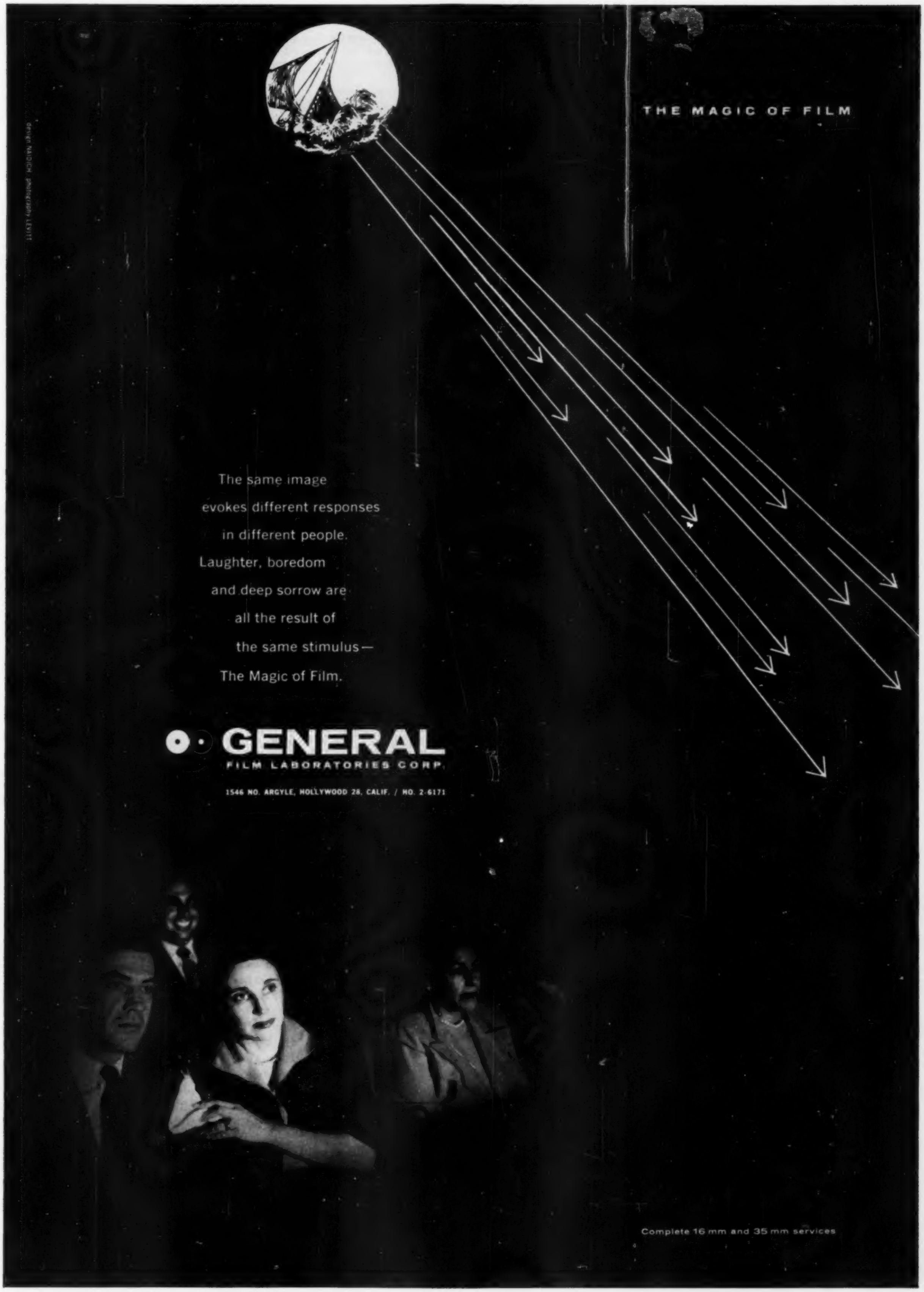
New Developmental Vidicons for Broadcast TV Use
L. D. MILLER, *Radio Corp. of America*

Anamorphic TV Circuit Requirements
MADISON CAWEIN, *Grimson Color, Inc., New York*
This paper discusses theoretical circuit requirements for anamorphic television, producing a wide-screen image (high aspect ratio) at the receiver. The relation of aspect ratio to pictorial information as regards frequency band, defined by the first elided frequency, is discussed. Pictorial information is defined in terms of contrast and resolution. The anamorphic squeeze and unsqueeze are described. Low-noise video and novel RETMA timing circuits are shown.

WEDNESDAY AFTERNOON

2:00 INSTRUMENTATION AND HIGH-SPEED PHOTOGRAPHY SESSION II

BTL Optical Tracking System for Nike Radar
K. L. WARTHMAN, *Bell Telephone Laboratories, Whippany, N.J.*
This presentation describes the lens design and camera modification to add instrumentation to the Nike radar for missile and target tracking. The tracking lens consists of a 30-in. telescope objective with neutral density filters and a reticle projection system. An optical flat with first surface coating is used for auto-collimation. The


THE MAGIC OF FILM
The same image
evokes different responses
in different people.
Laughter, boredom
and deep sorrow are
all the result of
the same stimulus—
The Magic of Film.
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FILM LABORATORIES CORP.
1546 NO. ARGYLE, HOLLYWOOD 28, CALIF. / HO. 2-6171
Complete 16 mm and 35 mm services

Bell & Howell 70H 16mm camera has been modified to add timing marks and message number for film identification.

A High-Resolution Exposure Control
GEORGE ECONOMOU, VLADIMIR W. LUBAN and MORTON H. MEHR, *The Perkin-Elmer Corp., E & O Division, Norwalk, Conn.*
Photography of distant objects requires accurate exposure to achieve maximum contrast with high-contrast emulsions. The auto-exposure unit has been designed for the ROTI Mark II tracking instrument to provide the control required to achieve these factors. A pair of graduated neutral density disks is used in the auto-exposure unit to vary the light level at the film plane. By maintaining full aperture, maximum resolution is achieved for all light conditions.

Feasibility and Preliminary Design Studies for Self-Contained Airborne Camera Pod
EVERETT L. MERRITT, *Photogrammetry, Inc., Silver Spring, Md.*
A requirement exists for a stereo camera system for determining earth-fixed position and orientation coordinates of a bomb during the first 300 ft of fall with special emphasis on the part from 200 ft to 300 ft. This system should be completely contained in a package which can be readily attached to the bomb rack of an aircraft. Specifications for the container and the stereo camera pair for the determination of the bomb coordinates relative to the camera pod are given. On the basis of simplicity of construction, a system is recommended which consists of a stereo camera pod and orientation of the pod relative to earth, and three accelerometers for change in the velocity components of the pod. The average velocity of the pod will be determined from the photographs of ground control points taken with stereo cameras or from theodolite data. Orientation data will be used to resolve the measured acceleration along the earth's fixed coordinates.

Photographic Instrumentation as Systems Concept
JOHN H. WADDELL, *Fairchild Camera & Instrument Corp., Jamaica, N.Y.*

35mm Framing Camera
FREDERICK P. WARRICK, *Frederick P. Warrick Co., Bloomfield Hills, Mich.*

Some Aspects of Time-Lapse (Stop-Motion) Cinematography in the Research Laboratory and Industry
HENRY ROGER, *Rolab Photo-Science Labs., Sandy Hook, Conn.*
Time-lapse photography is discussed and demonstrated. Applications in medical research, law, industry and agriculture are described. The section on medical research shows studies on normal and malignant cells of tissue and blood; human capillaries and studies on human eyes with an automatic "eye movement camera." Discussion of legal applications shows application to a patent litigation. Microscopic studies at low and high temperatures (freezing of motor oil, baking of bread and cake) are discussed and a study of plant growth by the use of time-lapse photography is shown.

An Image-Converter Tube for High-Speed Photographic Shutter Service
R. G. STOUDENHEIMER and J. C. MOOR, *Radio Corp. of America, Lancaster, Pa.*
A developmental image-converter tube having electrostatic focus, a gating grid, and electrostatic deflection is described. This tube is intended for multiple-frame photography of high-speed events with exposures as short as ten millimicroseconds. The various factors controlling screen brightness are presented so that they relate screen brightness to scene brightness. Actinic brightness of the screen can be greater than that of the scene under proper operating conditions.

High-Speed Films — Some Applications of High-Speed Photography

SMPTE Test Films

Test films planned by the Society's technical committees and produced under the Society's exact supervision are available from the headquarters office at 55 West 42 St., New York 36. Catalogs containing brief descriptions of each film are obtainable on request.

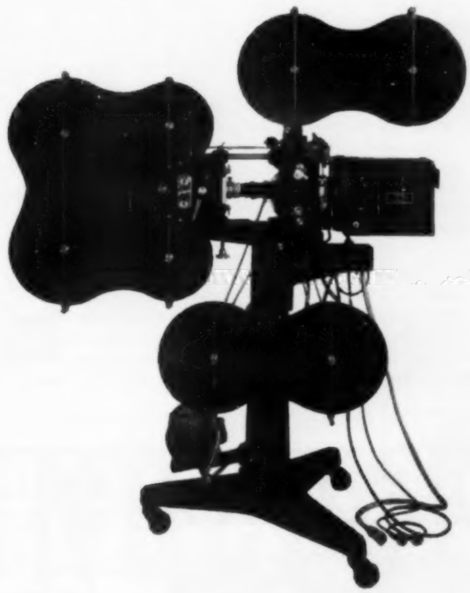
These films are used by manufacturers for testing the performance of new equipment, by television station technicians for lining up and adjusting film pickup systems, by maintenance men for "in service" maintenance of projectors and sound equipment, and by dealers for testing and demonstrating equipment.

Films are available in the following categories:

Television — Picture Only
CinemaScope
Visual 35mm — Picture only
Magnetic — 16mm Sound Only
Picture and Sound — 16mm
Picture Only — 16mm
Glass Slide — 16mm

DEPUE

Optical Reduction Printer



The Depue Reduction Printer has been a leader and pioneer in the film printing business, and for more than a quarter of a century has served the industry and laboratories—and served them well!

It is our continuous objective to maintain that leadership and continue to design and manufacture reduction printers that will enable you to do quality printing in an efficient manner.

The name "DEPUE" is your assurance of dependability and precision.

Your inquiries regarding this equipment will be welcome and receive our careful attention.

Oscar F. CARLSON Company

2600 Irving Park Rd. Chicago 18, Illinois

Industry, Education News

The Frontier, published by the Armour Research Foundation, brings reports on widely varying research for industry. The Armour Research Foundation of the Illinois Institute of Technology, 10 W. 35 St., Technology Center, Chicago 16, was founded in 1936 with three staff members and with less than a half-dozen research projects. The 1956 report lists more than 1200 full-time staff members and 700 research projects.

The Foundation's 1956 Report, "20 Years of Service Through Research" (52 pp., illus., 8½ by 11-in.), lists a few of its achievements which illustrate the wide range of its research activities. Among its contributions, during the 20 years it has been in existence, have been the first commercially practical magnetic recorder; flexible ceramic coatings that can be applied to a wide variety of materials at comparatively low temperatures; magnetic sound on film; an electronic instrument which measures and counts microscopic airborne particles such as dust, smog, moisture and pollen, 1000 times faster than by other methods; and the first stable, dry tortilla flour acceptable to the Mexican public.

Members of this Society have known for ten years and more about the Foundation's work on magnetic sound, from papers by Marvin Camras — "Magnetic Sound for Motion Pictures" in the January 1947 *Journal;* "Magnetic Sound for 8mm Projection" in the December 1947 *Journal;* and "New Magnetic Recording Head" in the January 1952 *Journal.*

Research during 1956 was carried on in eight main areas: Ceramics and Minerals, Chemistry and Chemical Engineering, Electrical Engineering, Engineering Economics, Mechanical Engineering, Metals, Physics, and Propulsion and Fluid Mechanics. There also is an international department which conducts projects in other countries.

During 1956, the Foundation carried on continuous research in magnetic recording, color measurements, high-speed photography, and optical system analysis, among other projects of special interest in the field of motion-picture and television engineering. One research project of less specific but of wide general interest is a study presently being carried on of sound propagation.

When an airplane flies faster than the speed of sound (760 miles per hour at sea level), it creates shock waves which are actually sound waves. People living in the vicinity of air fields have reported earthquake-like disturbances including shattered windows and dishes. One phase of sound propagation investigation covers the concentration of these disturbances and how the shock waves focus and coalesce.—*R.H.*

The shrinking world is becoming still smaller as the result of a 3 million dollar telephone-television system linking Cuba and the United States. A joint project of American Telephone and Telegraph Co. and International Telephone and Telegraph Co., the system makes use of transmitter antennas 60 ft sq which focus radio beams toward the receiving point. Although the curvature of the earth prevents direct reception of the beams, the signals are "bounced" off the atmospheric layers above the earth.

Placed into operation for telephone Sept. 12, there is considerable speculation as to just what this venture will mean to television. Television time will be sold at the rate of $600 for the first hour and $150 for each additional hour. The system is capable of carrying 200 telephone calls and 2 TV programs in each direction.

The system on the United States side is owned by AT&T's Long Lines Dept. and on the Cuban side by Radio Corp. of Cuba, an IT&T subsidiary. The system links Florida City, Fla., and Guanabo, Cuba. Nearest large cities are Miami and Havana to which programs will be carried by conventional microwave.

A 20-million dollar deal involving the distribution rights to a library of 600 feature motion pictures has been closed by Universal Pictures, Inc., and Screen Gems. Under the terms of the agreement Universal has licensed its pre-1948 film library to Screen Gems in return for a minimum guarantee of 20 million dollars over a 7-year period. Screen Gems will receive a graduated scale of distributor's fees and Universal will retain rights to the films. The television earnings of the films may amount to more than the 20 million guarantee.

The Television Division of the University of California Los Angeles has acquired a truck and trailer mobile unit for the pickup of remotes or outside broadcasts. The truck is a 2-ton GMC with over 6 ft of headroom and an overall length of 15 ft. It contains a built-in 5-kw generator sufficient for the University's 3-vidicon chain and enough lighting to make the unit independent of other power sources. The trailer is 20 ft long and is fitted with production and video desks, cabinets and interior lighting.

The American Institute of Physics has moved to new quarters at 335 E. 45 St., New York 17. The Institute, formerly located on 55 St., purchased the new building several months ago. Remodeling operations were completed in time for the scheduled move on June 7.

Forty-five outstanding medical motion pictures were shown at the American Medical Assn. annual meeting held June 3–7 at the Barbizon-Plaza Hotel, New York. There were films from 15 countries, almost all of them in color and all in English. Many of the films carried magnetic tracks with the English recording made in the country of origin. Film-running time varied from 10 to 53 min. Two films of general interest were: *The Motion Picture — A New Technique of Medical Investigation,* produced by J. Schlitz, Paris; and *Foreign Films in Health Education Around the World,* produced by the International Cooperation Administration, Washington, D.C.

Technirama's first use in England is described briefly in an article in *Kinematograph Weekly*, June 27, 1957. "Technirama's Large Frame Suits a 'Small' Picture," by Douglas Slocombe, explains the reasons for using Technirama in the motion picture *Davy*, a drama set in the small dressing rooms and narrow corridors of an old-fashioned English music hall.

"It was primarily," Mr. Slocombe said, "in order to emphasize the claustrophobic atmosphere. . .that we embarked on this entirely new venture of using the biggest possible frame to show a small picture." The experiment was an artistic success, Mr. Slocombe reported. "Owing to the great clarity of the system," he said, "we were able to pick out and use to great effect many unexpectedly rich touches of color that stood out against the dingy background, such as posters on the grimy gray walls and blobs of make-up on the artistes' littered dressing tables."

W. J. Turnbull has been elected Vice-President and member of the Board of Directors of National Theatre Supply Co., 92 Gold St., New York 38. Since 1951, he has been Vice-President in charge of the Company's Eastern District Sales. Mr. Turnbull has been with the company since 1933 when he was graduated from Georgia Tech.

Three new staff appointments have been made by Roger Wade Productons, Inc., 15 W. 46 St., New York 36. William Buckley, former president of Buckley-Loomis Productions, has been appointed production chief. Frank Furio, former TV-art director of Quality Bakers of America, is the new art director, and David C. Bigelow, former production manager of L. L. Loft Productions and vice-president of R. C. Bigelow Co., has been appointed production coordinator. The new appointments are made in conformance with the company's expansion plans.

United National Film Corp. is the recently approved name of the firm formerly known as Dallas Film Industries, Inc. It maintains the same address, 1011 Mercantile Securities Building, Dallas, Tex., where a new studio is nearing completion.

A second story addition to Editing Film Center, Hollywood, Calif., is expected to be completed in October. The new facilities will include 60 film storage vaults, 25 editing rooms, 2 projection rooms and office areas.

The Harwald Co., 1245 Chicago Ave., Evanston, Ill., has announced the opening of a new plant at that address. Manufacturers of Inspect-O-Film machines, the company has recently acquired the Movie-Mite 16mm sound projector.

The New York Branch of the Hollywood Film Co. has moved from 630 Ninth Ave. to 524 W. 43 St. The move was made because of the need for additional warehouse space and to provide for one-day service in the New York area.

Obituary

Lang S. Thompson

Lang S. Thompson, 1310 Hackberry Lane, Winetka, Ill., died July 9, 1957. He was Executive Vice-President of Wilding Picture Productions, Inc. He joined the firm in 1948 as account executive and was elected Vice-President in 1956. He was also President of Wilding-Henderson, Inc., a wholly-owned subsidiary.

The first state-sponsored educational closed-circuit television system will be installed in the Conley Hills Elementary School, Fulton County, Georgia, by the Radio Corp. of America during the summer. The multichannel installation will include four camera chains linked by closed-circuit with 26 receivers installed in classrooms throughout the school. Film and live TV programs will originate from a centralized TV studio within the school. The installation will be conducted on an experimental basis with a TV workshop established in Fulton County to acquaint teachers with the operation and scope of closed-circuit TV as an educational medium.

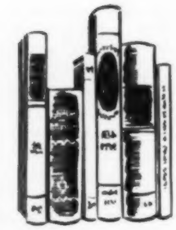
William Kenneth Cumming, former Director of Television Development at Stephens College, Columbia, Mo., and author of *This is Educational Television*, has been appointed Station Manager for WJCT, Channel 7, Jacksonville, Fla. A member of this Society, Mr. Cumming is also a member of National Association of Educational Broadcasters, Speech Association of America, University Film Producers Association and Association of Education in Journalism. Among other activities in the field of television he acted as consultant to RCA on the design of the TK-15 vidicon camera.

Loren E. Steadman has joined the Motion Picture Unit of Convair Astronautics, San Diego, Calif., as audiotronic engineer. Prior to his present position, he was technical director of Photographic Analysis Corp. North Hollywood. He served two years in the Army Signal Corps, Army Pictorial Center, Long Island City, N.Y.

S. W. Simmons of Dekko Cameras, Ltd., Telford Way, East Acton, London W.3, has been appointed a member of the Board. Mr. Simmons has been with the company since 1938 and has specialized in the development of kinematograph equipment.

Florman & Babb, 68 W. 45 St., New York 36, has announced two additions to the company's sales staff. Gerry Rich, formerly with Camera Equipment Co., has been appointed General Sales Manager. Leonard W. Hollander, formerly with De Luxe Laboratories, will specialize in nontheatrical and audio-visual services.

SMPTE Lapel Pins. Gold and blue enamel reproductions of the Society symbol, with screw back. Available to all members from Society headquarters. Price $4.00 including Federal Tax; in New York City, add 3% sales tax.



books reviewed

Acoustical Engineering (3d ed.)

By Harry F. Olson. Published (1957) by D. Van Nostrand Co., Princeton, N.J. i-xix + 703 pp. + 14 pp index. 571 illus. 6 by 9-in. Price $13.50.

This third edition of Dr. Olson's book on the subject of acoustics has had its title shortened to *Acoustical Engineering* from *Elements of Acoustical Engineering* that appeared as the heading of the second edition in 1947 and the first edition in 1940. The original edition made use of certain of the subject matter included in a series of 30 lectures prepared by the author for use at Columbia University. The second edition retained much of the material of the 1940 book, and, in addition, incorporated many of the advances that were made during the seven years intervening between the two editions.

There are 16 chapters and 703 numbered pages in the third edition, compared to 14 chapters and 527 pages in the preceding one. The headings of the 14 chapters that appear in the second edition have been used without change as headings for corresponding chapters in the third edition but the material in the chapters has been expanded and brought up to date where developments have been significant. The fourteen chapters cover such subjects as: sound waves, acoustical radiating systems, mechanical vibrating systems, dynamical analogies, acoustical elements and measurements, microphones, loudspeakers, miscellaneous transducers, architectural acoustics, speech, music and hearing, underwater sound, and ultrasonics.

In the second edition, the subject of "Complete Sound Reproducing Systems" is discussed in the last ten pages of the chapter headed "Architectural Acoustics," whereas in the 1957 edition it is expanded to 32 pages and occupies an entire chapter of its own. Stereophonic disk and magnetic tape reproducing systems are considered in this third edition, as is a binaural magnetic tape sound reproducting system and a multiple-channel sound motion-picture reproducing system (stereophonic). Transistor-type hearing aids as well as those employing subminiature vacuum tubes are included, and a number of block diagrams are provided showing both amplitude and frequency-modulated radio broadcasing system layouts as well as a perspective view of a complete television system.

The other added chapter is headed "Means for the Communication of Information" and covers a considerable amount of new material including such subjects as: sound generators, facsimile, visible speech, speech and music synthesizers, language

translator and control of machines by speech.

The phenominal growth of interest in high-fidelity reproduction of speech and music in the home during the past few years, is reflected not only in the nearly 50% increase in the number of pages in the chapter devoted to "Direct Radiator Loudspeakers" in this third edition, but also in the number of new subjects presented in the chapter, under such headings as: compound direct radiator loudspeaker, drone cone phase inverter, loudspeaker mechanisms for small space requirements, and cabinet configurations.

The chapter devoted to "Miscellaneous Transducers" has been nearly doubled in size in this latest edition. Much of the new material covered is perhaps indirectly the result of the impact on photograph recording and reproducing techniques caused by the appearance of the long-play record in the interval between the second and third editions of the book that we are discussing here. Consider these topic headings that are newly presented: heated stylus, ceramic turnover pickup, feedback pickup, compliance of pickup, and tone arm resonance. The possibilities offered by the fact that magnetic tape can be operated over a range of speeds from a fraction of an inch per second to the order of a thousand inches per second, are also explored briefly in this chapter. These possibilities include frequency conversion, frequency compression (taking advantage of the fact that the redundancy in normal speech is comparatively large), and time compression.

The "Measurements" chapter shows a sizable increase (19) in its number of pages in the third edition of *Acoustical Engineering*, reflecting the availability of new tools, new techniques, and recognition of the increased importance assigned to subjective measurements. The topics covered in this last-named category also reflect the growth of high fidelity in the home, as witness: loudspeaker environment; loudspeaker housing, placement and mounting; relative loudness efficiency; relative directivity; frequency range; power handling capacity; nonlinear distortion, and transient response.

A major orchestra conductor would be somewhat disconcerted to come onstage and see a symphony orchestra seated as shown in Fig. 1138 on p. 549, or a concert orchestra as indicated in Fig. 1139 on p. 550, with the double reeds (oboes, English horn, bassoons) separated. The flutes and oboes should be interchanged in the first drawing and the clarinets and oboe in the second.

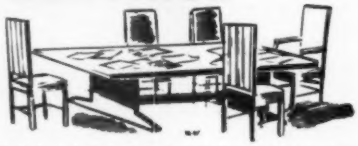
A certain amount of confusion may result in an atttempt to interpret the three graphs at the bottom of p. 127 and the three at the top of p. 125. The description refers to loudspeakers having cone diameters of 1 in., 4 in. and 16 in., in that order. The graphs, on the other hand, are in the reverse order, and, reading from left to right, present data on loudspeakers having cone diameters of 16 in., 4 in. and 1 in. A notation on each graph as to the cone diameter represented would end the difficulty once and for all. This is a minor problem and one that will undoubtedly be resolved in future printings.

One convenience that has been incorporated in the third edition is the placing of the chapter headings at the tops of the right hand pages. Each chapter is substantially complete in itself, requiring a minimum of turning to preceding and succeeding chapters when one is looking up a particular subject.

The content of the book are arranged in logical fashion, the material admirably presented and the typography excellent. Dr. Olson tells us on p. 661 that there are 55,000,000 telephones in this country. That figure was presumably obtained sometime prior to March, 1957, the date given on the preface sheet. The figure is already out of date, so fast does the communications business expand. As of March 31, 1957, the total number of telephones in the United States, served by the Bell System and the Independents, was over 61,000,000, and by the time that this review appears in print, the March 31 figure will also be antedated.—*Iden Kerney*, Bell Telephone Laboratories, Inc., Murray Hill, N.J.

The 25th semiannual edition of Television Factbook published by Television Digest, Wyatt Bldg., Washington 5, D.C. (476 pp. priced at $5.00 including TV wall map) gives information about every station in the United States and Canada. Altogether 43 countries now have TV, and for the first time the *Factbook* tally shows more countries with some form of advertising than without it — by a score of 23 to 20.

engineering activities



This report presents a résumé of the major topics of discussion at the engineering committee meetings held during the Society's 81st Convention in Washington, D.C., April 29 – May 3, 1957:

Sound

Most of the work of this committee is proceeding very nicely through the cooperation of the numerous ad hoc committees:

PH22.51, Intermodulation Tests, 16mm Variable-Density Photographic Sound

This proposal was published in the January 1956 *Journal* for a three-month period of trial and criticism. Since adverse comments were received, an Ad Hoc Committee was formed to study this proposed revision. The Chairman reported continued activity on the project.

Four-Track Magnetic Release Print Sound Records for 35mm Film

A compromise proposal, resolving the objections to the second draft was submitted to the Sound Committee by the Ad Hoc Committee. Although the Sound Committee members present voted in the affirmative, it was decided to ballot the entire committee on this proposal.

PH22.82-1951, Sound Transmission of Perforated Projection Screens

In accordance with ASA rules on five-year periodic review of all American Standards, PH22.82 was submitted to the Sound Committee for a decision as to reaffirmation, revision or withdrawal. The Committee decided that the existing specification for sound transmission is still applicable. However, it was felt that the method of testing screens should be more detailed. It was recommended that the specification on hole size and spacing be referred to the Screen Brightness and Film Projection Practice Committees for a better optical performance description.

Several of the test films under the committee's jurisdiction were discussed:

16mm Azimuth Test Film, Magnetic-Type

The committee unanimously approved the fourth draft of this proposal. It was suggested that all future test film standards involving a description of signal level be referred to the Society's 16mm Magnetic Signal-Level Film and expressed in terms of magnetic induction for accuracy and consistency with magnetic test films.

16mm Multifrequency Test Film, Magnetic-Type

The Chairman of the Ad Hoc Committee appointed to study this test film presented a Progress Report. Malcolm Townsley (ISO delegate) requested a formal statement from the committee as to the proposed elimination of the de-emphasis from the replay chain characteristics. The committee unanimously reaffirmed the U.S. position as to the inferential de-emphasis in the test film as being consistent with the U.S. industry position.

A request for information regarding 16mm review room recommendations presently controlling the quality of sound reproduction was submitted to the committee. Roger Beaudry was assigned the task of examining the present situation with reference to television film and will submit a report to the Committee.

Film-Projection Practice

There was a discussion concerning the standardization of CinemaScope-type sprockets and a Subcommittee will be formed to study this proposal. Herbert Behrens read a detailed Subcommittee Report on heat control in projection. It is expected that the work of the Subcommittee will be completed shortly and a final report will be presented at the October Convention.

Walter Beyer presented a report on a proposed test target for an all-purpose alignment and visual test film. This report has been circulated to the Committee and will be discussed at the next Convention.

PH22.28, Focal Lengths and Markings of 35mm Motion-Picture Projection Lenses

This proposal has been published for a three-month period of trial and comment and if no adverse comments are received, it will be submitted to ASA Sectional Committee PH22 for further processing as an American Standard.

The Committee approved the appointment of a Subcommittee to revive the question of Projection-Room Planning because of the many new developments since the last study undertaken by the committee in 1951.

The problem of damage to film by the indiscriminate placement of cue marks inside the picture area was referred to the committee for its consideration. Following the meeting, John B. McCullough was appointed Chairman of a Subcommittee that will be appointed to investigate the problem.

Laboratory Practice

Revision of the Laboratory Nomenclature Standard, Z22.56-1947, has been under Committee consideration for several years. At this meeting, a report on the first draft of Section 1 disclosed that some changes would be necessary. The many comments received were discussed item by item and it was decided to rewrite this Section and circulate it to the committee in the form of a second draft in the near future.

The brightness of screens in hard-top and drive-in theaters as well as in review rooms is presently being measured and it is expected that the committee will make a study of the data as it pertains to release film density.

16 & 8mm

The meeting was completely devoted to standards activity:

PH22.7, 16mm Motion-Picture Camera Image
PH22.19, 8mm Motion-Picture Camera Image

These 1950 standards have been under

study by the Committee for some time. A. C. Robertson presented a proposed revision of PH22.7 which offers a possible solution to many of the objections concerning this Standard. Inasmuch as PH22.7 and PH22.19 have been processed simultaneously, the conclusions affecting PH22.7 would also apply to .19.

16mm Camera Spools

Study of this proposal has been under committee consideration since 1948. A first draft has been prepared and will be circulated to the committee in the near future.

PH22.11, 16mm Motion-Picture Reels

A proposal was made to revise this Standard to include reel sizes of 600 ft, 1000 ft and reels of greater capacities.

PH22.76, Lens Mounts for 16mm and 8mm Cameras

The first draft of the proposed revision of this Standard was circulated to the Committee in August 1956. Adverse comments were received pertaining to the designation of the mounts. A second draft is being prepared, incorporating the necessary changes.

PH22.107, Film Spools for 8mm Cameras

The committee is presently studying several proposed versions of this Standard in an effort to reach a satisfactory conclusion.

PH22.38, Raw Stock Cores for 16mm Motion-Picture Film

PH22.50, Reel Spindles for 16mm Motion-Picture Projectors

PH22.83, Edge Numbering 16mm Motion-Picture Film

These Standards are up for periodic review and it appears that there is no objection to their being reaffirmed.

PH22.24, Splices for 16mm Motion-Picture Films for Projection

PH22.77, Splices for 8mm Motion-Picture Films

While these Standards were being reviewed a proposal was made to specify the thickness of the splices. This question is still under Committee consideration.

High-Speed Photography

A discussion concerning the compilation of a list of definitions pertaining to high-speed photography took place. It was suggested that the list of terms should not only present a general dictionary definition but also a more specific technical definition. On the completion of this list it is expected that it will be forwarded to the Royal Naval Scientific Service of the Admiralty, London, England, for review prior to its presentation to the International Symposium on High-Speed Photography.

A status report on the progress of the SMPTE Recommended Practice on Lens Mount Surface for High-Speed Motion-Picture Cameras was presented. This Recommended Practice has subsequently been approved by the Board of Governors, published in the August *Journal* and reprinted for general distribution.

A general discussion was held concerning the publication of High-Speed Photography Reprint Volume 6. The consensus was that it would be advisable to continue the series and that the Chairman should convey the committee's feelings to the Publications Advisory Committee and to the Board of Editors.

Plans for the Fourth International Congress to be held at Dusseldorf, Germany, in September 1958 were discussed. The Chairman requested assistance in securing papers for presentation at the Congress. Furthermore, a working committee was established to consider preliminary planning of the Fifth International Congress which is scheduled to meet in the United States in 1960. It was suggested that photographic organizations and the government may wish to participate.

PH22

A status report was presented on the fifteen standards reviewed by the committee since January 1956. Since there were no other standards presently under consideration by the committee, the entire meeting was devoted to international standardization.

The progress of the ten Second Draft ISO Recommendations was reviewed. There appears to be general agreement between these Recommendations and related American Standards. Although some numerical differences exist in the way in which the dimensional tolerances have been rounded off, the Chairman recommended that the ASA approve the Recommendations.

Mention was made of the five ISO Draft Proposals which are still under active consideration. The progress of the seven ISO Working Groups organized at the 1955 Stockholm meeting was noted. The chairman advised the Committee that the next ISO meeting is to be held at Harrogate, England, in June 1958.

Television

A letter ballot on the proposal on TV Projector for Vidicon Camera Operation was circulated to the Committee and the several adverse comments received were discussed in detail, particularly those pertaining to the control of light intensity reaching the face of the vidicon. The proposal has been returned to the Subcommittee for further work.

It has been found that when producing a color film for use over a television system certain precautions must be taken to insure that adequate contrast between objects of different colors is still preserved when the picture is viewed on a monochrome television receiver. A Subcommittee has been formed to study this problem.

A uniform method of sync marking was discussed and it was reported that while some agreement has been reached more time would be needed to study the problem.

A lengthy discussion was held on printing recommendations concerning the minimum and maximum density that is desirable for television reproduction. Paul Ireland was asked to look into this problem and report to the Committee on his recommendations.

Color

The activities of several of the Subcommittees were reviewed: The Subcommittee commissioned to investigate the projection light sources and screens for color films has had some difficulty in obtaining data on the spectral reflectance characteristics of new and old screens. However, it appears that a workable plan for obtaining at least abridged information is now possible.

The Subcommittee which is investigating spectral energy of photographic illuminants reported that a new system had been worked out to describe the spectral emission of light sources, the spectral transmittance of correction filters and spectral response of color films in terms of "photographic index." These indexes are on a logarithmic scale so that simple addition or subtraction gives the total effect of light, filters and film. It is expected that the Committee will be able to complete this project and write it up for publication some time this year.

A proposal prepared by the Subcommittee on densitometry of color film soundtracks was submitted to the parent Committee. One negative vote was cast and the proposal has been returned to the Subcommittee for suitable revision.

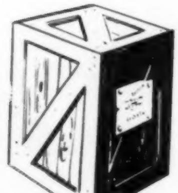
The monograph *Elements of Color in Professional Motion Pictures* has been distributed without charge to all members of the Society. The reaction has been quite favorable and extra copies have been printed and are now available at a nominal cost.

Closed Circuit Television

An exploratory session was held to determine the nature and extent of current and possible future interest in closed-circuit television. Thirty-eight representatives from some 22 companies participated in the informal discussion. It was decided that an Ad Hoc Committee should be formed to formulate a scope of activity and an initial program of work to be undertaken. It was also suggested that this Committee effect coordination with organizations doing related work. Axel G. Jensen, Engineering Vice-President, subsequently appointed Dr. Raymond L. Garman of General Precision Laboratory as Chairman of the Ad Hoc Committee.—*J. Howard Schumacher*, Staff Engineer.

If Its Photography There's an American Standard is a 16-page booklet that lists and describes 42 American Standards for camera; 26 for films, plates and papers; 3 on microfilm; 30 on processing and processing equipment; 70 on photographic grade chemicals; 7 on projection; 89 on motion pictures. The booklet is available without charge from the American Standards Association, 70 E. 45 St., New York 17.

Membership Certificates (Active and Associate members only). Attractive hand engrossed certificates, suitable for framing for display in offices or homes, may be obtained by writing to Society headquarters, at 55 West 42nd St., New York 36, Price: $2.50.



new products (and developments)

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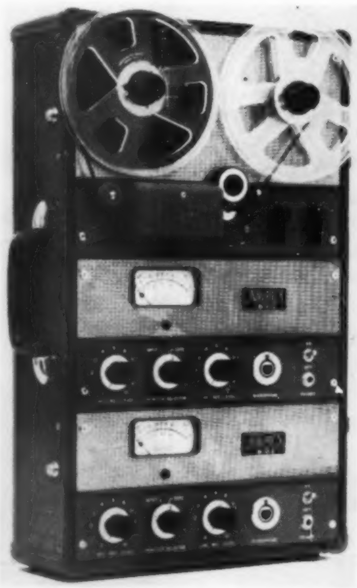
Further information about these items can be obtained direct from the addresses given. As in the case of technical papers, the Society is not responsible for manufacturers' statements, and publication of these items does not constitute endorsement of the products or services.



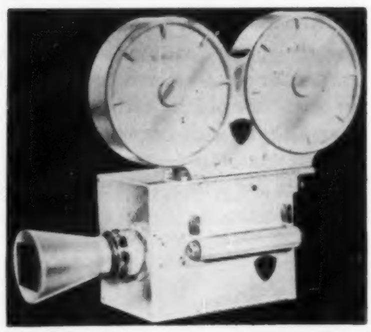
Ampex Model 601-2 is a portable 2-track stereophonic recorder which uses precision in-line heads for recording and reproducing. Interchannel crosstalk is reported below the inherent noise level. Separate microphone and line inputs and level controls on each channel permit stereophonic mixing. The unit records both stereo and single-channel tapes and plays back stereo, full or halftrack tapes. It is contained in a carrying case and priced at $995.00. Further information is available from Ampex Corp., 934 Charter St., Redwood City, Calif.

The Elwood Densitometer and Light Meter is a product of Fotomatic Corp., 2603 Kessler Blvd., North Drive, Indianapolis 22. It is an instrument for measuring light quantities and light qualities It consists essentially of a light-sensitive crystal, a meter, and a mercury-type battery power supply. There are no electronic tubes or parts. The crystal is cadmium selenide, reported to be "ultra-stable" as a result of recent developments in mounting and production. In operation, a voltage is applied to the crystal and a microammeter in a series circuit. A tap switch is used to apply 6 different voltages to the circuit. The switch provides on-off operation of the meter.

The meter is not calibrated to any one application. It is made to read in per cent, with blank scales provided for inserting with particular calibrations. A lens tube is included as an extra attachment. The sensitive crystal probe may be inserted in the tube and the unit used as a light meter for measuring small areas of light from a distance. The lens tube contains a lens and a diffusing glass. The diffusing glass is located at about the center of the tube so the scene or subject aimed at is observed in fine detail on the glass. A slot is provided in the tube so the crystal probe may be in between the lens and the diffusing glass. The probe is clear plastic so the small crystal appears on the ground glass as a small black spot. To measure a part of the scene, it is covered by the black spot on the ground glass.

Suggested uses include contact printing, enlarging, x-ray analysis, light measurements and color printing. It is priced at $118.00.

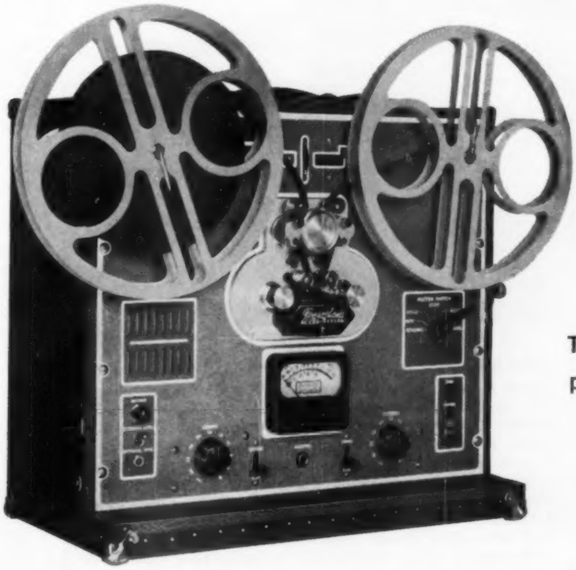
A lenticular projection screen, designed to show motion pictures, slides and TV under normal room lighting conditions, is manufactured by the Universal Screen Co., Clinton, Mass. It was exhibited for the first time at the National Audio Visual Association Convention held July 19–24 at Chicago. The screen is reported to have complete directional control enabling a viewer at 45° from the projection axis to receive the same reflective brilliance as a viewer at 15°. The lenticular design was constructed to give maximum reflection of projected light and at the same time to resist outside light. The screen is especially applicable to classroom viewing in that it makes unnecessary the installation of special "black-out" devices.



The Photo-Sonics 4B Camera, manufactured by Photo-Sonics, Inc., has been designed for research in missile and related rapid-motion projects. It is a rotating-prism camera, with a rotating disk shutter provided in interchangeable units with openings of from 5° to 60° available. A film capacity of 500 ft is provided in a removable film chamber. Further information, including cost, is available from the distributor: Gordon Enterprises, North Hollywood, Calif.

NEW MAGNASYNC-MAGNAPHONIC ALL-IN-ONE SOUND SYSTEM

cuts set-up time for on-the-go producers



TYPE 15, series 400
price **$1385.00**

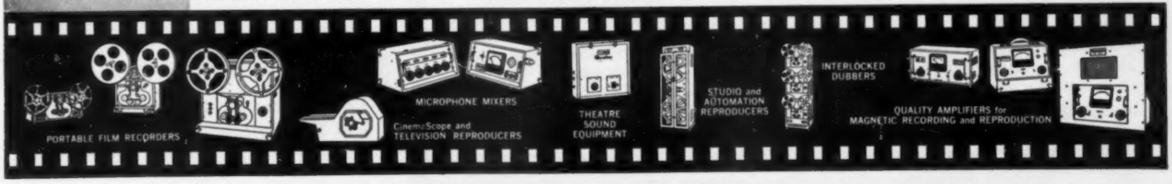
Here, in a single portable case, is a complete, top-quality sound system. Playback monitor amplifier, loudspeaker and recorder are all built into this one compact package. Just open the case and you're in business!

FEATURES—

- Accurate, easy-to-read footage counter.
- Direct coupled torque motors.
- Simplified single-switch for motor control functions.
- Simultaneous film monitor
- "RECORD" indicator lamp.
- 1200-foot film capacity.

Panel size: 19"x 15¾"; Weight 59 lbs.

INTERNATIONAL LEADERS IN THE DESIGN AND MANUFACTURE OF QUALITY MAGNETIC FILM RECORDING DEVICES



MAGNASYNC MANUFACTURING CO., LTD., 5546 Satsuma Ave., North Hollywood 2, Calif.

MAGNASYNC
Magnaphonic SOUND SYSTEM

DEALERS

NEW YORK—Camera Equipment Co., 315 W. 43rd St. New York 36 JUdson 6-1420. Cable Address CINEQUIP.

CHICAGO—Zenith Cinema Service, Inc., 3252 Foster Ave., Chicago 25, Ill. IRving 8-2104.

SAN FRANCISCO—Brooks Camera Co., 45 Kearney St., San Francisco, Calif. EXbrook 2-7348.

INDIA—Kine Engineers, 17 New Queen's Rd., Bombay India.

A monobath for films developed by Harry S. Keelan, Research Associate, Boston University Physical Research Laboratories, Boston 15, is reported to eliminate many of the disadvantages of earlier processes, such as instability, uneven development, excessive softening of the emulsion, loss of speed and higher fog. A description of the monobath was presented before the American Chemical Society at its meeting in Miami in April 1957.

In developing his process, Mr. Keelan used sodium aluminate both as buffer and alkaline hardener to eliminate the disadvantages with the exception of speed and higher fog. Subsequently the addition of compounds of extremely high redox potential, such as triaminophenol trihydrochloride, eliminated loss of speed. Finally the availability of phenidone along with Panatomic X film eradicated the remaining disadvantage — fog.

Panatomic X film was simultaneously developed and fixed in 90 sec at 90 F to a gamma of 1, an ASA Exposure Index of 25, a fog of 0.25, with a resolution for more than 70 lines/mm. At 68 F, the processing time is 3 min, the gamma 0.80, and the fog 0.21.

The Forney Cinetron, a power source reported to be adequate to the lighting requirements of any normal set, either sound-stage or on location, has been announced by Forney Industries, Box 563, Fort Collins, Colo. Features are combination 110–230 v input, three-in-one "Color Kelibrator," heavy-duty power cords with twist lock receptacles, 60-amp breaker, and zero load adjustment. It is priced at $349.00 f.o.b. Fort Collins, Colo.

The Vanguard Instrument Corp., 184 Casper St., Valley Stream, N.Y., has announced that the Vanguard M-16C Motion Analyzer is now available with provision for mounting automatic data readout to the X, Y and frame count outputs. This enables the operator, after manually positioning the crosshairs, to feed readings to IBM card punches, punched tapes or electric typewriters. Readings are initiated by depressing a foot switch.

A television tube that uses an extremely thin transparent phosphor layer instead of a coating of phosphor powder was exhibited by the General Electric Research Laboratory, Schenectedy, N.Y., at the Western Electronics Show and Convention held Aug. 20–23 at San Francisco. The company has also announced a color tube called the "penetron" which is made by applying transparent layers of different phosphors to the tube face and changing the operating voltage to produce the desired color.

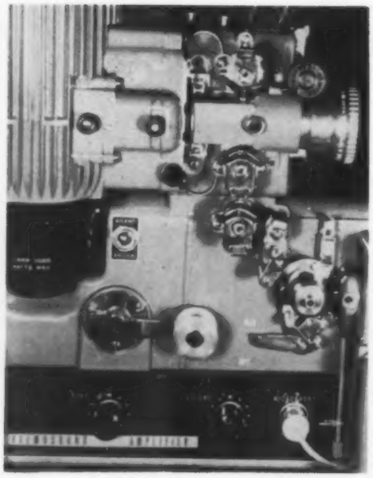
The announcement describing the method of coating the tube with a phosphor layer stated that it had been "invented several years ago" by Dominic Cusano and Frank Studer. The "penetron" was announced as having been developed by Lewis Koller. The three scientists are associated with the GE Laboratory.

A device described as an image-orthicon life-extender has been announced by the General Electric Co. Technical Products Dept., Syracuse, N.Y. Designed to prevent burn-in and sticking of images on image-orthicon tubes, it is expected to extend greatly the life of the tubes which now ranges from about 200 to 1000 hours. The "life-extender" operates with an electronic deflecting system used to move or "wobble" the image inside the tube. To offset the wobble, a scanning beam inside the tube follows and automatically compensates the wobble, causing the transmitter picture to appear as a normal, stationary image on TV receivers. The complete unit comprises about 50 small parts, including 6 capacitors, a synchronous resolver and a drive motor. With cover closed, it is about the size of a cigar box.

A report on a station test showed the device as enabling a tube to be used effectively for more then 1400 hours. It will be priced at about $1,200.00.

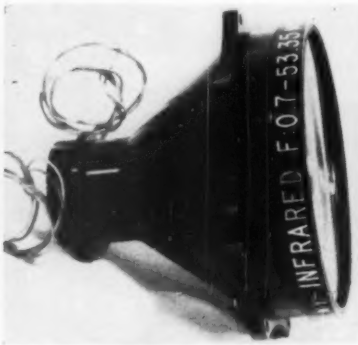
TV camera designed for military use on land, in the air and underwater has been announced by Admiral Corp., 1191 Merchandise Mart, Chicago 54. The camera is reported to be so sensitive that it can "see" as much by the light of a match as a man with normal vision by the light from a 150-w bulb. The image-orthicon camera weighs approximately 75 lb and measures 26 in. long, 13 in. wide and 17 in. high. The optical system of the camera is located on the bottom and it is built to operate at depths up to 1000 ft.

Two new types of vidicon TV tubes have been announced as in production and immediately available by General Electrodynamics Corporation, Garland, Texas. These are the GEC 6198-A, intended primarily for industrial use, and the 6325-A, a studio-quality tube for film-scanning and live broadcast purposes. New design features include the elimination of the side tip which characterized earlier models and attachment of a special particle shield to keep any loose particles of cathode and getter material from falling on the light-sensitive surface. This makes it possible for these GEC Vidicons to be operated in the face-down position, previously not recommended.

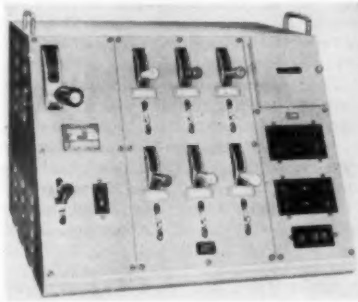


A Magnetic Playback Conversion Unit for the Bell & Howell Filmosound Projector, for erase-proof magnetic playback, has been developed by Binghamton Magnetic Industries, Inc., Binghamton, N.Y. The unit permits the reproduction of magnetic and optical soundtracks individually or simultaneously with no change in threading. It is designed to scan at 28 frames and with frequency response conforming to SMPTE standards. It is priced at $99.50. The distributor is Williams, Brown and Earle of Philadelphia.

The Picto-Scope, an anamorphic lens announced by the Apex Specialties Co., Providence 4, R.I., is designed in three models: the Professional for 8mm and 16mm motion-picture cameras and projectors; the Imperial for 16 mm zoom lens or studio or location 35mm camera work; and the Imperial Model F.M. for 35mm theater projectors or 35mm camera work. The lenses are suited for color or black-and-white film.



High-speed optics designed for use in earth-satellites have been developed by Zoomar, Inc., Glen Cove, N.Y., for the Army Engineering Laboratory. Mounted opposite each other, the optics will alternate in facing the earth's surface as the satellite rotates. Including the housing, they have a speed of $f/0.7$ with a diameter of 3 in. and a weight of 2½ oz. The optics will pick up infrared radiation reflected from the clouds and will be focused on a very small detector unit. Solar batteries will activate each unit as it faces the earth's surface, and will turn off the equipment when the satellite is on the dark side of the earth. The information collected by the devices will be telemetered back to earth.



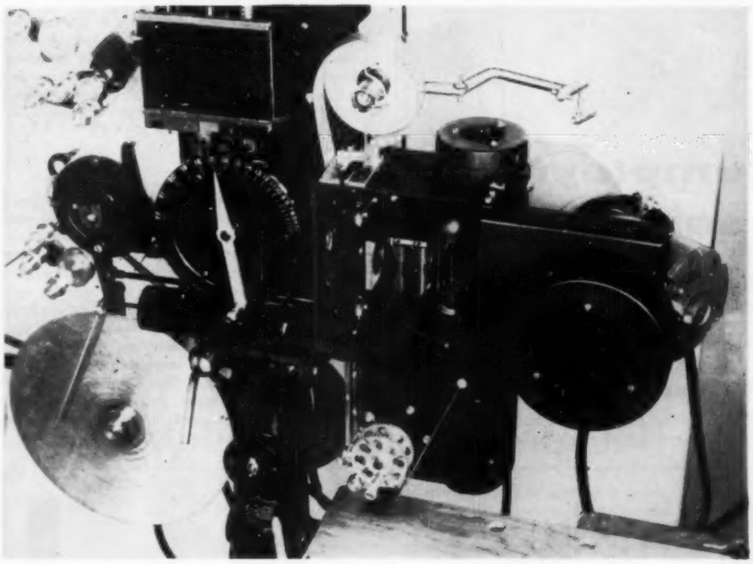
Packaged Luxtrol light control equipment which can be used as a portable unit or stacked to build a large switchboard is a product of the Superior Electric Co., 83 Laurel St., Bristol, Conn. The DC-2500 series is recommended for schools, theaters and other applications which require individual circuit control up to 2500 w. The company's Bulletin LI57P, a 28-p catalog, describes the units which come as 3, 4, 5 and 6 controllers with individual controller ratings of 2500 w is available from the company.

The Graybar Guide to Industrial TV-With Equipment Selector is a 64-page illustrated catalogue issued by Graybar Electric Co., 420 Lexington Ave., New York 17. The catalogue is divided into 7 sections: (1) A Guide to Industrial and Closed Circuit Television; (2) Video and Optical Equipment for Closed-Circuit TV System; (4) Audio Equipment for TV Systems; (5) Transmission and Distribution Equipment for ITV Systems; (6) Serving and Maintenance of ITV Equipment; (7) Engineering Data for ITV Systems. The first section includes an account of the many applications of industrial TV, ranging from training and educational uses to theft detection. The catalogue is available upon request from the company.

GPL Model PD-500, a self-contained, closed-circuit TV camera' has been announced by General Precision Laboratory, Inc., Pleasantville, N.Y. It weights 12 lb. and is 12 in. long, 5 in. wide and 7½ in. high. Included within that space are the camera, camera circuitry and camera controls. Priced at $1,250, including camera tube and a 3-lens manually operated turret, it complements the company's Model PD-150 camera chain.

A technique for the dynamic measuring of small-signal characteristics of each transistor before using it in a new design has been developed by the Cubic Corp., 5575 Kearney Villa Rd., San Diego 11, Calif. The technique enables the circuit designer to examine simultaneously a series of electrical parameters in the circuit laboratory. Employing a multipurpose switching circuit composed of two transistors, the newly developed examination technique permits quantitative measurements using a calibrated oscilloscope for rapid design analysis. In making the desired measurements, a curve tracer is used. In a typical circuit laboratory setup a family of curves of transistor characteristics is displayed on the face of a standard cathode-ray oscilloscope. The specific range of examination can be controlled so that one or more characteristic curves can be selected and the inclusive electrical boundaries of the curves as presented can be varied over wide limits.

General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass., has issued a supplement to Variac Bulletin O which describes recent additions to its Variac series. The bulletin is obtainable upon request from the company.



A traveling mat filter-changer for conversion of black-and-white printers to color has been introduced by Houston Fearless, 11801 West Olympic Blvd., Los Angeles 64. Manufactured for use with Bell & Howell D and J printers, the unit consists of a high-intensity lamphouse, master pack, optical system, mat transport and rewind mechanism and edge printing light. An electrical control panel, complete with rectifiers and transformers, is designed for ease and precision of operation.

The Saint Cecilia Co., Westwood, N.J., manufacturer of Bel-Cleer tape for musical recording, has announced its expansion into the field of magnetic tape for instrumentation, telemetering and video tape recording. The company is a subsidiary of Durby Laboratories, Inc.

employment service

These notices are published for the service of the membership and the field. They are inserted three months, at no charge to the member. The Society's address cannot be used for replies.

Positions Wanted

Film Writer-Editor, with directorial experience, now engaged in post-graduate work at City College Institute of Film Techniques. Three years experience in direction of off-Broadway theater. Has written scripts for NBC-TV and industrial films. Experienced with all 16mm cameras and editing equipment. Formerly with Screen Gems, Inc. Willing to relocate. Write: Lawrence G. Cohen, 55 Nagle Ave., New York 40.

Producer-Director-Cinematographer. Comprehensive background in all phases of motion-picture production: creative, technical and artistic. More than 13 years in motion-picture, live-television and radio production. Independent producer 6 years. Experience also includes writing, editing, acting and narration. Very fluent Spanish including technical terms. Desires position with production company or in motion-picture department of large industrial corporation. Interested in the United States, Central or South America. Résumé available in English or Spanish. Write: Oliver E. Cain, P.O. Box 1594, Amarillo, Texas.

Stereoscopy. Seeking opportunity for research and development work in phases of motion-pictures and television leading to an accurate reproduction of the illusion of life such as stereoscopic sight (unaided), binaural sound, smell, etc. Have done independent research for 10 yr and prepared book on integrated high-speed stereo. Robert B. Collender, 58 Van Reipen Ave., Jersey City, N. J.

Audio-Visual Supervisor. Master's degree in education, specializing in production of audio-visual materials. AB in English. Experience in educational television production, planning and production of industrial films. Former audio-visual supervisor for guided missile manufacturer, heading motion-pictures and military presentations. Now engaged in educational film production. Will consider educational or industrial work. Age 32; married. Larry J. Beck, 4303 South 7th St., Tacoma, Wash. Tel: SK 23056.

Sales Representative. Experienced, mature, versatile (editing, cinematography, recording, scripting), supervisory and administrative ability. Former active producer; kinescope recording experience; capable of sales representation on top agency and client level. Excellent references; free to travel and relocate; married; age 34; 15 yr active film experience. Write: c/o Artz, 1365 York Ave., New York 21.

Cinematographer-Photographer. Six yr professional experience in all phases photography, motion-picture, still, color, film editing and production. Two yr photo and cinema school. Presently working as plant photographer in large industrial plant. Age 26, single, will relocate. Desires TV, industrial or production work. Résumé on request. Write: I. Mann, 1123 West Pratt Blvd., Chicago 26.

Film Writer-Director now heading film unit large national organization. Administrative experience. Interested in connection with business film producer, film laboratory service department or industrial photo unit. Thorough knowledge all phases of film production including TV spots, animation techniques, public relations, sales and training films. Write: Film Director, 4410 Walsh St., Chevy Chase 15, Md.

Engineering and Technical Film Producer. Background in all phases of technological and industrial film production including direction, camera, editing, business management; presently and for many years producer with own company. Now seeking position that will allow concentration exclusively on production of technological films either with production company or large industrial corporation, preferably in the western states. J. K. P., 4003 Cumberland Ave., Hollywood 27, Calif.

Recording Director for Slide Films. Thorough knowledge available talent and recording techniques. R. Goldhurst, 913 Second Ave., New York, N.Y. PLaza 9-7654.

Motion-Picture Cameraman-Technician. Age 40, single with car, free to travel. 15 years experience in cinematography, B & W and color, including animation, titling and special effects. Thorough knowledge of 16mm and 35mm production equipment. Capable editor, experienced in laboratory developing, sensitometric control and printing. Commercial and college-unit production experience. B.A. degree; graduate of New Institute for Film and TV, New York. Active member SMPTE. Seeks position with commercial film producer, college unit, or internal industrial film group. References, complete resume on request. Joseph MacDonald, 2414 Sullivant Ave., Columbus 4, Ohio. Tel: BR 6-2053.

TV Stage Manager. NYU graduate, worked with active motion-picture, TV and stage groups, presently employed as cameraman with Artists Enterprises, seeking position as program assistant or stage manager for TV studio. Resume on request. Write: Reg Gamar, 279 92 St., Brooklyn 9, N.Y.

Motion-Picture Cameraman. Well rounded background in every phase of motion-picture photography, including 3 years as cameraman with leading university. Desire to become affiliated with stable film unit. Married. Age 31. Free to travel. Write: John Viazanko, 1207 Krameria St., Denver 20, Colo.

Positions Available

Motion-Picture Development Engineer. Mechanical engineer or equiv. required by long-established motion-picture developing machine concern. Must be thoroughly familiar with machine design and construction and capable of supervising projects through manufacturing processes. Technical knowledge of color and spray processes desirable. Salary open. Send resume with references and salary requirements to: Filmline Corp., 43 Erna Ave., Milford, Conn.

Photographic Engineers. GS-11; $6390/yr; requirements: engineering degree plus 2½ yr general engineering experience including 1 yr specialized experience in the photographic field. GS-12; $7570/yr; requirements: engineering degree plus 3½ yr general engineering experience including 1 yr experience in the photographic field. GS-13; $8990/yr; requirements: engineering degree plus 4 yr general engineering and administrative experience including 1 yr specialized experience in the photographic field. Contact Civilian Personnel Office, Employee Utilization Div., Bldg. 787, Fort Monmouth, N.J., as soon as possible. All positions will be located in vicinity of Fort Monmouth, with a minor amount of travel involved.

Motion-Picture Equipment Maintenance Men. Experience on 35mm Cameras helpful, but not absolutely essential. Our shop has openings for skilled machinists in 35mm projectors, arclamps generators, rectifiers, printers, processors, Movieolas, etc. Write fully to William Allen, S.O.S. Cinema Supply Corp., 602 West 52 St., New York 19.

The U. S. Civil Service Commission has revised and reissued the announcement of the currently open examination for engineer. The new announcement incorporates examinations for various specialized branches of engineering formerly publicized in separate announcements. Pay for various positions ranges from $4,480 to $11,610 a year. For further information consult Civil Service Examination Announcement No. 112 B obtainable from most post offices or from the U. S. Civil Service Commission, Washington 25, D.C.

Film Library Supervisor. $5280–$6460/yr. Requirements: Minimum qualifications: Graduation from a standard senior high school or possession of a high-school equivalency diploma. Minimum experience: One year of satisfactory experience in reviewing, evaluating, maintaining and planning for the distribution of motion-picture film, and in addition any one of the following: Four more years of experience; graduation from a recognized college or university from a 4-year course for which a bachelor's degree is granted with specialization in radio, television and motion-picture production or a satisfactory equivalent combination of the foregoing training and experience. Applications for examination will be accepted through Sept. 20 at the New York State Dep't of Civil Service, State Office Building, Albany, N.Y.

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News Columns

Advertisers

Meeting Calendar

American Institute of Chemical Engineers, Regional Meeting, Sept. 15–18, Lord Baltimore Hotel, Baltimore, Md.

American Society of Mechanical Engineers, Fall Meeting, Sept. 23–25, Statler Hotel, Hartford, Conn.

Standards Engineers Society, 6th Annual Convention, Sept. 23–25, Commodore Hotel, New York.

Institute of Radio Engineers and American Institute of Electrical Engineers, Industrial Electronics Conference, Sept. 24–25, Morrison Hotel, Chicago.

82nd Semiannual Convention of the SMPTE, Oct. 4–9, Sheraton Hotel, Philadelphia.

National Electronics Conference, Oct. 7–9, Hotel Sherman, Chicago.

American Institute of Electrical Engineers, Reliability and Quality Control in Electronics, Oct. 10, Silver Spring Md.

American Society of Civil Engineers, National Convention, Oct. 14–18, Statler Hotel, New York.

Institute of Radio Engineers, Canadian Convention, Oct. 16–18, Toronto, Ont., Canada.

Acoustical Society of America, National Meeting, Oct. 24–26, Univ. of Michigan, Ann Arbor, Mich.

American Standards Association, Eighth National Conference on Standards, Nov. 13–15, San Francisco.

IRE, ASQC, AIEE, RETMA, Fourth National Symposium on Reliability and Quality Control, Jan. 6–8, 1958, Hotel Statler, Washington, D. C.

83rd Semiannual Convention of the SMPTE, including Equipment Exhibit, April 21–26, 1958, Ambassador Hotel, Los Angeles.

Fourth International Congress on High-Speed Photography, including Equipment Exhibit, Sept. 29–Oct. 4, 1958, Cologne.

84th Semiannual Convention of the SMPTE, Oct. 20–24, 1958, Sheraton-Cadillac, Detroit.

American Standards Association, Ninth National Conference on Standards, Nov. 18–20, 1958, Hotel Roosevelt, New York.

85th Semiannual Convention of the SMPTE, including International Equipment Exhibit, May 4–8, 1959, Fontainebleau, Miami Beach.

86th Semiannual Convention of the SMPTE, including Equipment Exhibit, Oct. 5–9, 1959, Statler, New York.

87th Semiannual Convention of the SMPTE, May 1–7, 1960, Ambassador Hotel, Los Angeles.

88th Semiannual Convention of the SMPTE, Fall, 1960, Shoreham Hotel, Washington, D. C.

89th Semiannual Convention of the SMPTE, Spring, 1961, Royal York, Toronto.

90th Semiannual Convention of the SMPTE, Oct. 15–20, 1961, Statler, New York.

SMPTE Officers and Committees: The rosters of the Officers of the Society, its Sections Subsections and Chapters, and of the Committee Chairmen and Members were published in the April 1957 Journal.

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  United Artists Corporation
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Moviola Manufacturing Co.
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  Carbide and Carbon Corporation
National Screen Service Corporation
National Theatre Amusement Co.
Neighborhood Theatre, Inc.
Neumade Products Corp.
Northwest Sound Service, Inc.
Panavision Incorporated
Pathé Laboratories, Inc.
Polaroid Corporation
Producers Service Co.
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